DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
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C.I.F. A29507456

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
76719RRF.004A1

Partial Test Report

USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Central In-Vehicle Infotainment Computer CIVIC Gen20xi.3
(*) Trademark	BOSCH
(*) Model and /or type reference	BCI3L3R1 / vehicular architecture: Star3.0
(*) Derived model not tested	BCI3L3R1 / vehicular architecture: Star3.5
Other identification of the product	FCC ID: 2AUXS-BCI3L3R1
(*) Features	AM/FM/DAB(SXM US version)(/TV JP Version) W-LAN 2.4GHz /5GHz MIMO / SiSO - no DFS Bands, AP / Client Bluetooth 5.2 LE& EDR GNSS multiple HW version: D5 SW version: E064.4
Applicant	Robert Bosch GmbH Robert-Bosch-Strasse 200 31139 Hildesheim Germany
Test method requested, standard	USA FCC Part 15.247 (10-1-23 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-23 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 3 (August 2023). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2025-06-12
Report template No	FDT08_25 (*) “Data provided by the client”

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Acronyms

Acronym ID	Acronym Description
Detector	Detector used
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
MP	Measurement Point
Mod	Modulation
Mode	MIMO Mode
Pol	Polarization
Port	Active Port
Unwanted Freq	Unwanted Emissions Frequency
Unwanted Lvl	Unwanted Emissions Level

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 1 GHz is: Measurement uncertainty ≤ ± 5,35 dB with factor (k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is: Measurement uncertainty ≤ ± 4,32 dB with factor (k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 26 GHz is: Measurement uncertainty ≤ ± 5,51 dB with factor (k = 2).

The total uncertainty of the measurement system for the conducted testing of EUT is:
RF Peak Output Power: Measurement uncertainty ≤ ± 0,80 dB
RF Average Output Power: Measurement uncertainty ≤ ± 0,99 dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample consists of a Central In-Vehicle Infotainment Computer CIVIC Gen20xi.3

Including:

GNSS (GPS, Galileo Beidou Glonass)

AM/FM/DAB (ROW/ECE)

AM/FM/SXM (NA)

AM/FM/TV (JP)

WLAN 2.4 &5GHz

Bluetooth

3. Declaration of similarity

Cross-Domain Computing Solutions

BOSCH

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FCC BCI3L3R1 - Product Variant Declaration Star 3.0 vs Star 3.5 May 13, 2025

Ladies and gentlemen,

We, Robert Bosch GmbH, herewith declare that our product **BCI3L3R1** exists in two variants, which are electrical identical in all aspects.

HVIN (Model Name)	BCI3L3R1
FCC ID:	2AUXS- BCI3L3R1

The product is mounted in two different vehicle types:
- one with a CAN Bus Vehicle communication system,
- the other one has vehicular Ethernet as communication system

In order to be operational in these vehicles, our product is preconfigured in two variants as described below. Both are **HW identical,** only that different path for in-vehicle communication is used.
The CAN and Ethernet interface are always built on both Star architectures, but only Star 3.0 uses the CAN interface, and Star 3.5 uses Ethernet interface.

The following block diagrams show the architectures:

Registered Office: Stuttgart, Registration Court: Amtsgericht Stuttgart, HRB 14000;
Chairman of the Supervisory Board: Prof. Dr. Stefan Asenkerschbaumer;
Managing Directors: Dr. Stefan Hartung, Dr. Christian Fischer, Dr. Markus Forschner,
Stefan Grosch, Dr. Markus Heyn, Dr. Frank Meyer, Katja von Raven, Dr. Tanja Rückert

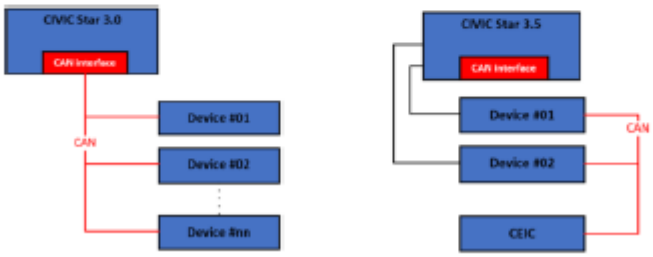
Cross-Domain Computing Solutions

BOSCH

May 13, 2025
Page 2 of 2

Variant **Star 3.0** **Star 3.5**

Blockdiagram Star Architectures



From regulatory point of view, we, BOSCH, consider the impact of the variant coding as follows:

	CAN Bus / Ethernet Bus
Radio Requirements	No impact
Health Requirements	No impact
Electrical Safety Requirements	No impact
EMC Requirements	Radiated emissions

Yours sincerely

Dirk_Zamow

Digitally signed by Dirk_Zamow
Date: 2025.05.14 08:34:48 +02'00'

By: Dirk Zamow
Title: Grantee Main Contact
Telephone: +49 5121 49 2608
e-mail: dirk.zamow@de.bosch.com

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results. The laboratory is not responsible for such information and it is not covered by accreditation.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	76719D_149.1	Headunit A-PREMIUM ECE	BCI3L3R1	CM0203R0015425	2024-10-25	Element Under Test
S/02	76719D_148.1	Headunit A-PREMIUM ECE	BCI3L3R1	CM0203R0015425	2024-10-25	Element Under Test
S/01 & S/02	76719D_48.1	Fakra- USB adapter cable	--	--	2024-10-25	Auxiliary Element
S/01 & S/02	76719D_60.1	Termination box	--	--	2024-10-25	Auxiliary Element
S/01 & S/02	76719D_63.1	Fakra- 4 SMA cable	--	--	2024-10-25	Auxiliary Element
S/01 & S/02	76719D_111.1	Harness	--	--	2024-10-25	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for BTLE/BTEDR testing.
S/02	Samples used for WLAN testing.

Test sample description

Ports…… :	**Port name and description**	**Cable**		
		Specified max length [m]	**Attached during test**	**Shielded**
	Main Connector	*2m*	[X]	[ ]
	Fakra Quad Connector AM/FM/DAB *Fakra Single Connector GPS*		[X]	[ ]
	Fakra Quad Connector WLAN/BT		[X]	[ ]
	USB Cable		[X]	[ ]
Supplementary information to the ports…… :	--			

Rated power supply .....:	**Voltage and Frequency**		**Reference poles**				
			L1	**L2**	**L3**	**N**	**PE**
	[ ]	AC:					
	[X]	DC: 9-16V nomimal 12 VDC by vehicle battery					

Rated Power .....:	--	
Clock frequencies.....:	--	
Other parameters.....:	IP20 ; -40C toi +65C	
Software version .....:	E064.4	
Hardware version.....:	D5	
Dimensions in cm (W x H x D) ....:	220mmx161mmx78mm	
Mounting position.....:	[ ]	Table top equipment
	[ ]	Wall/Ceiling mounted equipment
	[ ]	Floor standing equipment
	[ ]	Hand-held equipment
	[X]	Other: Cluster in the car with separate antennas built into the cockpit of vehicle

Modules/parts.....:	**Module/parts of test item**	**Type**	**Manufacturer**
	--		
Accessories (not part of the test item) .....:	**Description**	**Type**	**Manufacturer**
	Antennas		
	Display		
	any other equipment to make device functional		
	Laptop		
Documents as provided by the applicant.....:	**Description**	**File name**	**Issue date**
	--		

Identification of the client

Robert Bosch GmbH
Robert-Bosch-Strasse 200, 31139 Hildesheim
Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2025-01-14
Date (finish)	2025-02-02

Document history

Report number	Date	Description
76719RRF.004	2025-06-04	First release.
76719RRF.004A1	2025-06-12	Second release. Modification due to typos. This modification test report cancels and replaces the test report 76719RRF.004.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Pablo Redondo and Carmen Vázquez

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
06791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
06792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06609	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-22
06615	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-04
06143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2027-01-22
06142	PRE-AMPLIFIER G>38dB 30MHz-6GHz	BLNA 0360-01N	BONN ELEKTRONIK	2025-07-25
06496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2026-12-01
03783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2026-03-17
04657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2026-06-12
08856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2025-02-27
07817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2026-07-01
07445	DC POWER SUPPLY 30V/5A	U8002A	KEYSIGHT TECHNOLOGIES	N/A
07760	DIGITAL MULTIMETER	175	FLUKE	2025-11-07
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
06793	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06611	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-04
07794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2025-04-21
07796	EXTENSION FOR OPEN SWITCH UNIT UP TO 40GHz	OSP-B157Wx	ROHDE AND SCHWARZ	2027-01-09
08848	OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE AND SCHWARZ	2027-01-02
00922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	N/A
05850	DIGITAL MULTIMETER	179	FLUKE	2025-11-04
07798	SOFTWARE FOR EMC/RF TESTING	WMS32	ROHDE AND SCHWARZ	N/A

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P

Summary

Bluetooth Low Energy (2M, 1M):

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/A	(1)
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P*	(2)
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/A	(1)
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/A	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: (1) Test not requested by client. (2) Worst case channel and modulation only.			

Bluetooth EDR

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/A	(1)
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P*	(2)
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/A	(1)
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/A	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: (1) Test not requested by client. (2) Worst case channel and modulation only.			

WLAN 802.11 bgnax 1x1:

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/A	(1)
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P*	(2)
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/A	(1)
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/A	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: (1) Test not requested by client. (2) Worst case channel and modulation only.			

Appendix A: Test results. Bluetooth Low Energy (2M, 1M)

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RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power 18

RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter) 20

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	12 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Technology	Antenna Gain	Type
BTLE:	+0.1 dBi	External

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel
BTLE GFSK	1M 1 Mbit/s	2402 MHz	2440 MHz	2480 MHz
BTLE GFSK	2M 2 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

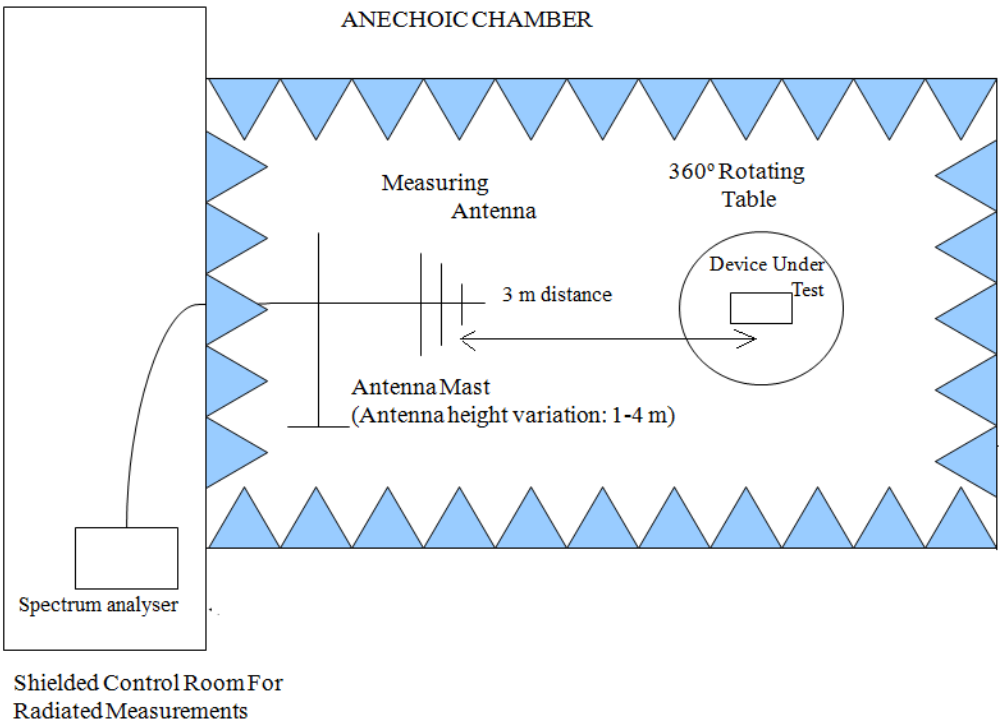
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

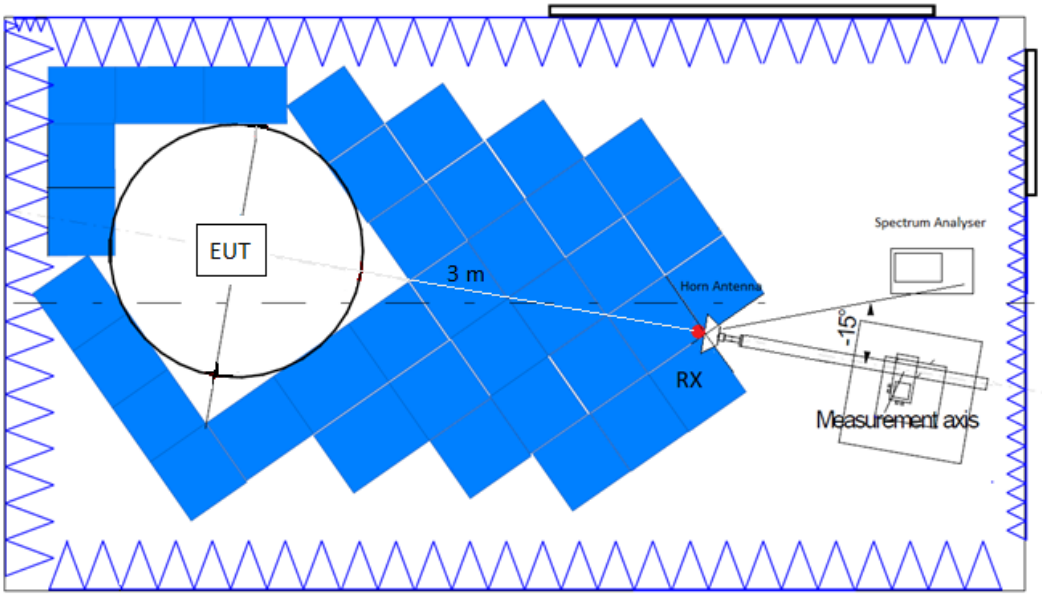
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

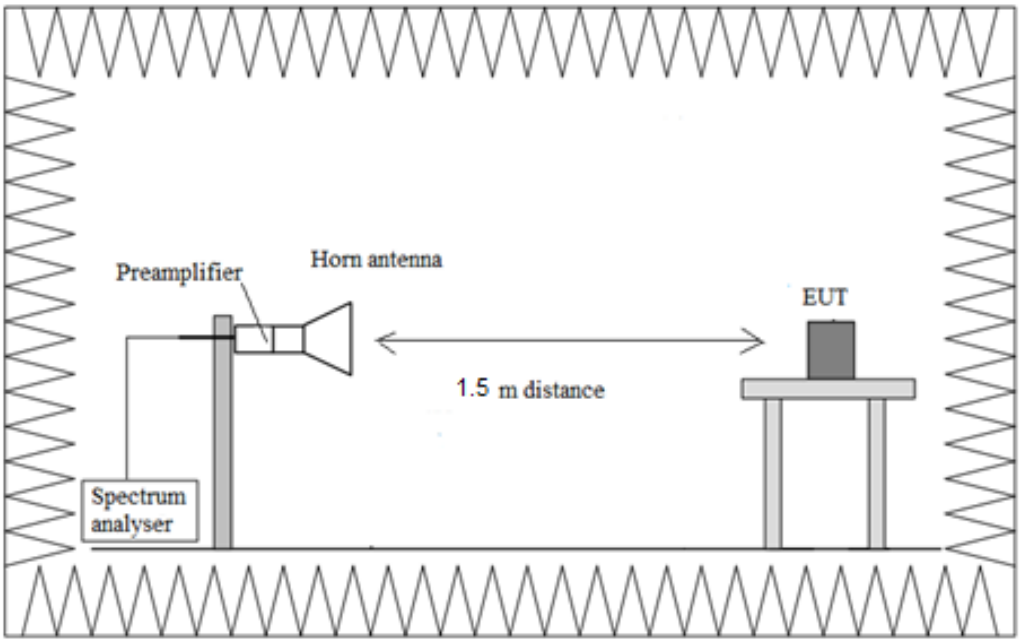
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power

Limits

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 ”RBW ≥ DTS bandwidth” of ANSI C.63.10-2013.

Results

Worst case channel and modulation only.

Modulation: BTLE 5.0 (GFSK 1 Mbit/s)

Freq (MHz)	Peak Power (dBm)	Maximum EIRP Power (dBm)
2402.00000	-7.390	-7.290

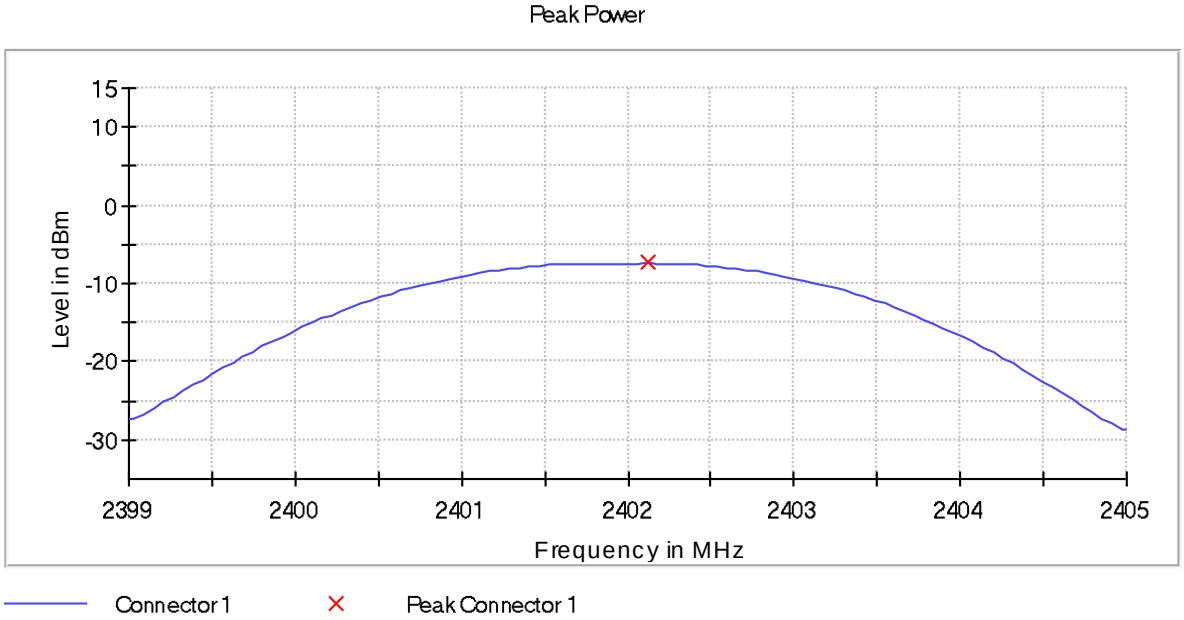
Verdict

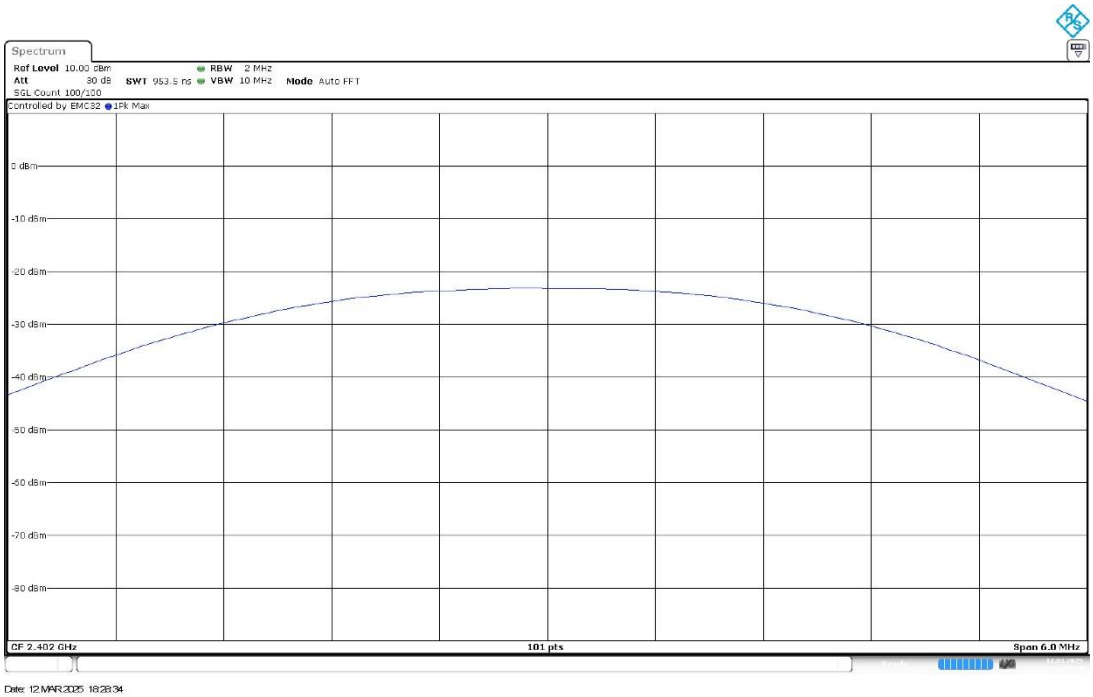
Pass

Attachments

Equipment Type = Digital Transmission System (DTS)	Bandwidth MHz = 1
Modulation = BTLE 5.0 (GFSK 1 Mbit/s)	Frequency MHz = 2402.00000
Antenna configuration = SISO	Active Port = 1

Images:





RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)

Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.
Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Results

Modulation: The spurious frequencies detected do not depend on either the modulation or the operating channel.

Freq Rng (GHz)	Equipment	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[0.03, 1]	Digital Transmission System (DTS)	1	37.420	20.32	V	PK
				18.09	V	QP
			79.615	20.73	V	PK
				18.20	V	QP
			600.021	31.94	V	PK
				28.63	V	QP
			714.965	24.34	V	PK
				18.20	V	QP
			895.385	19.34	H	QP
			895.385	25.49	H	PK
			898.295	24.61	V	PK
			898.295	19.33	V	QP

Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]

Equipment Type = Digital Transmission System (DTS)

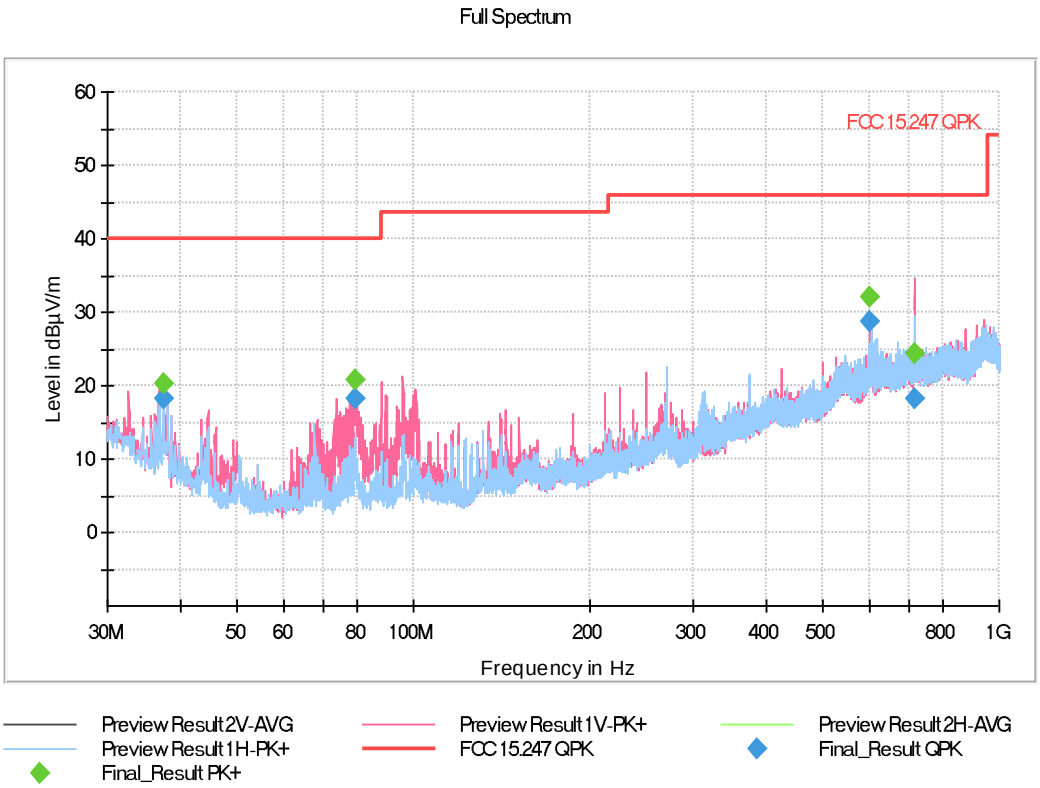
Modulation = The spurious frequencies detected do not depend on the modulation.

Frequency MHz = The spurious frequencies detected do not depend on operating channel.

MIMO Mode = SISO

Active Port = 1

Images:



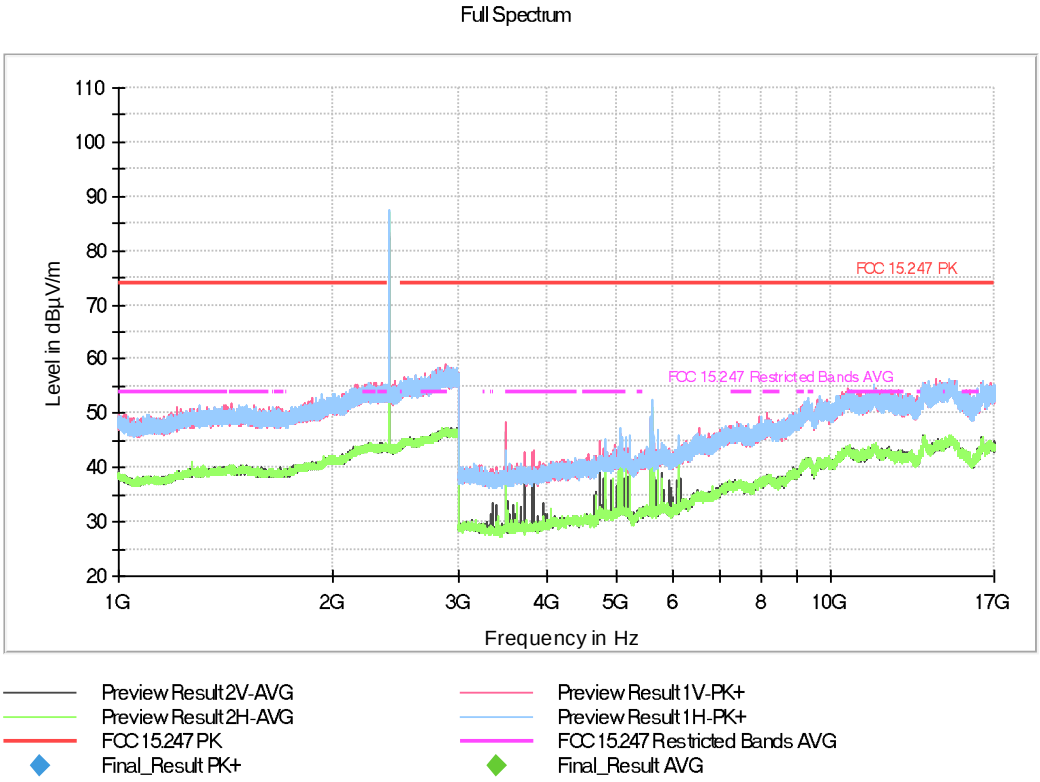
Tables:

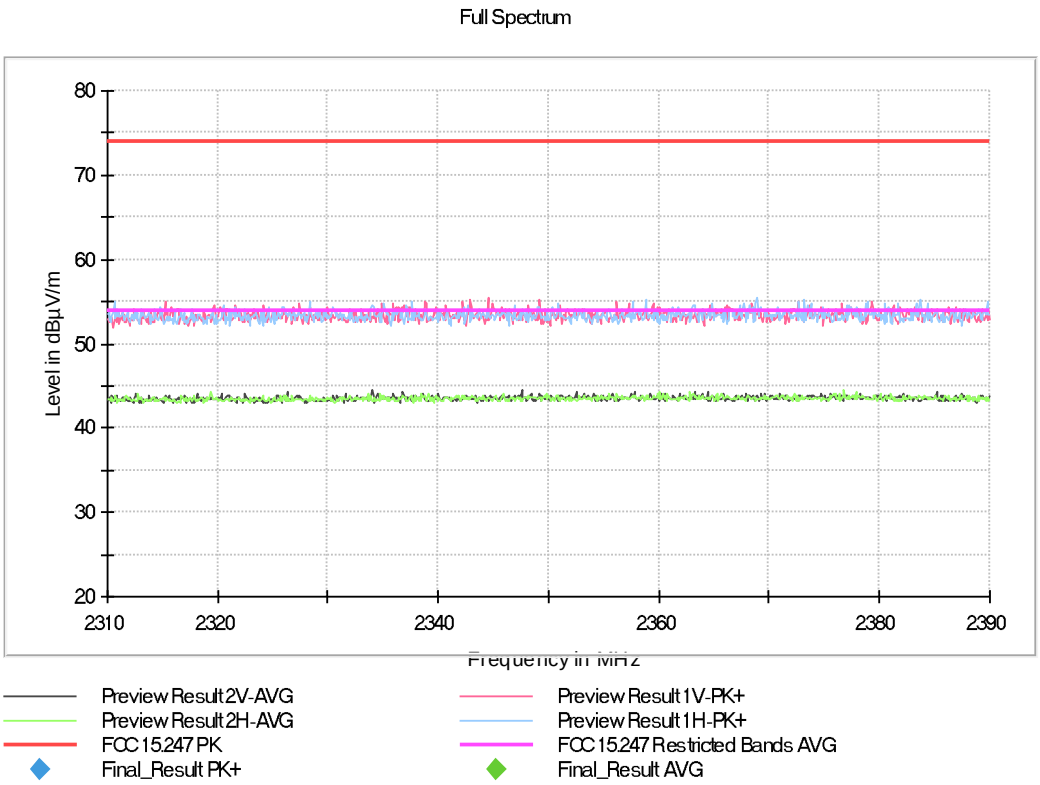
Spectrum Analyzer Parameters

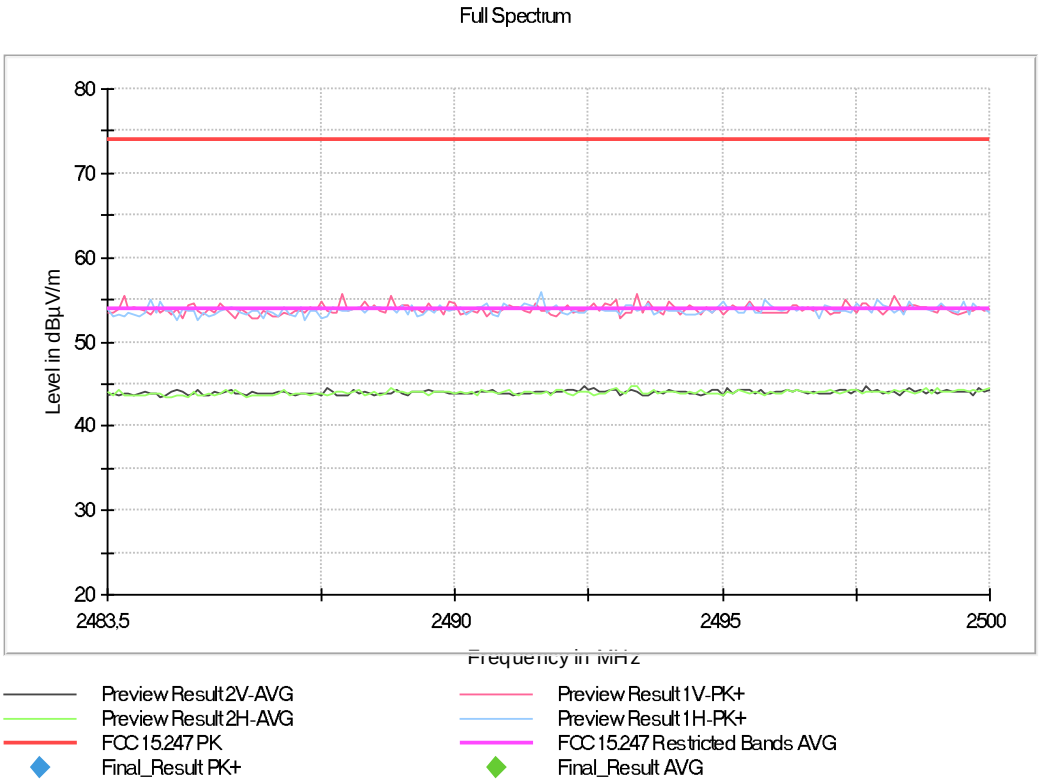
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	0 dB

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 1 Mbit/s)
Frequency MHz = 2402.00000
MIMO Mode = SISO
Active Port = 1

Images:

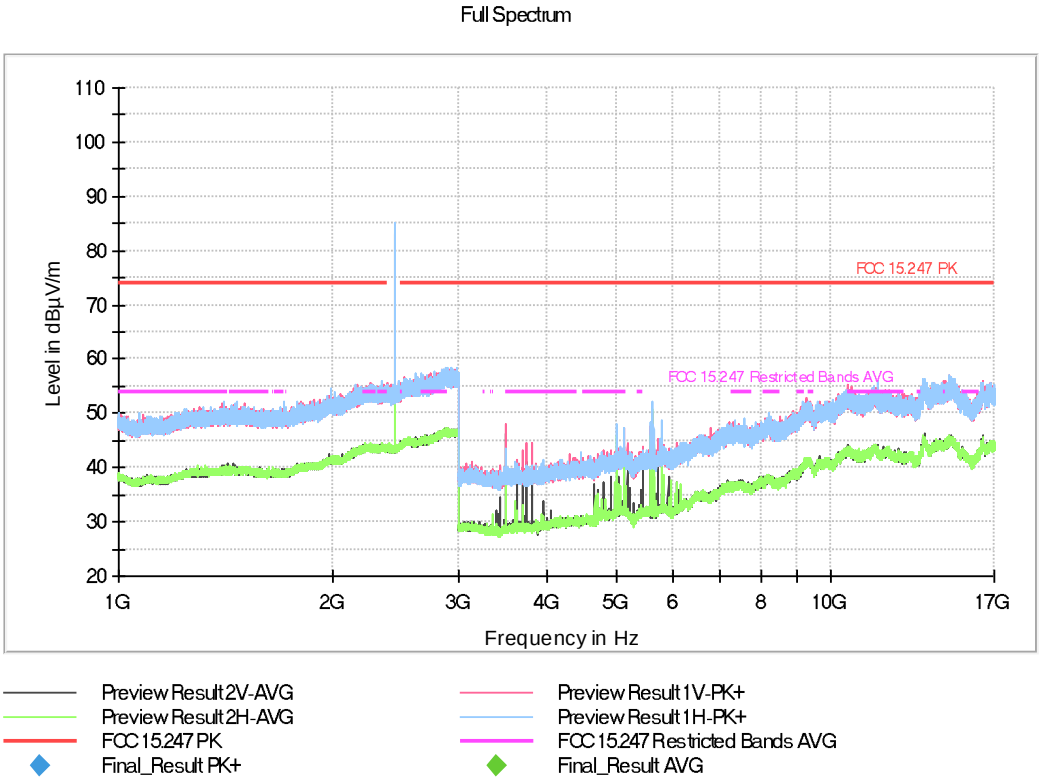


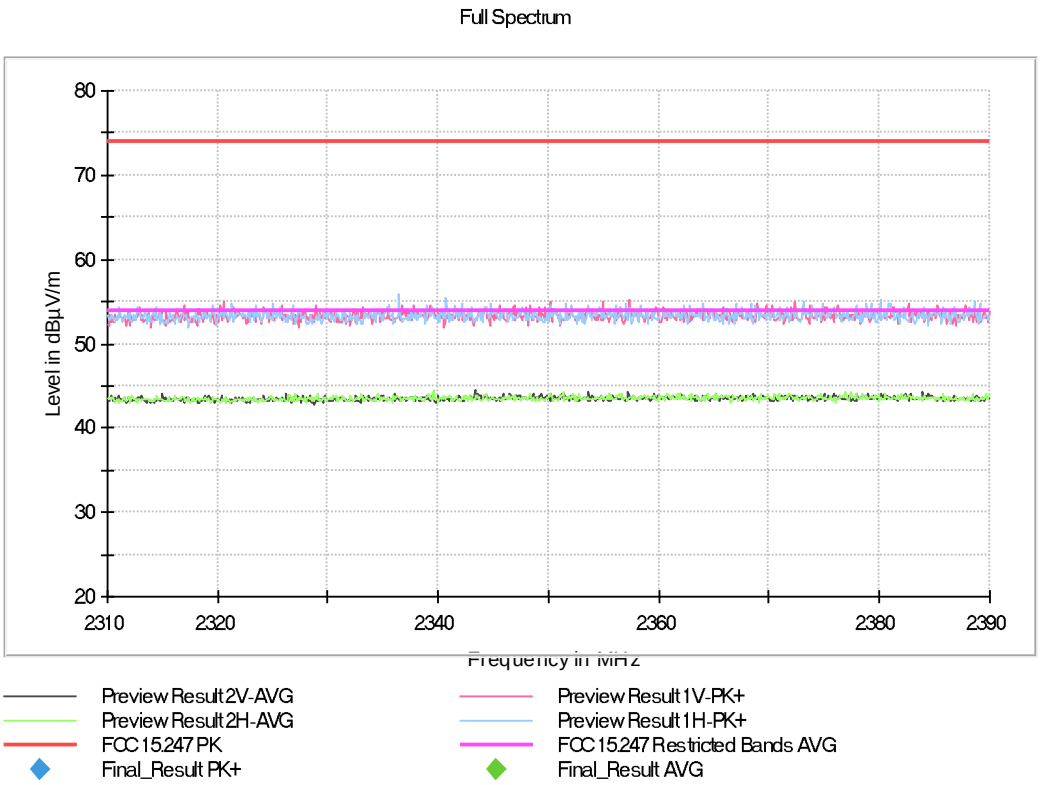


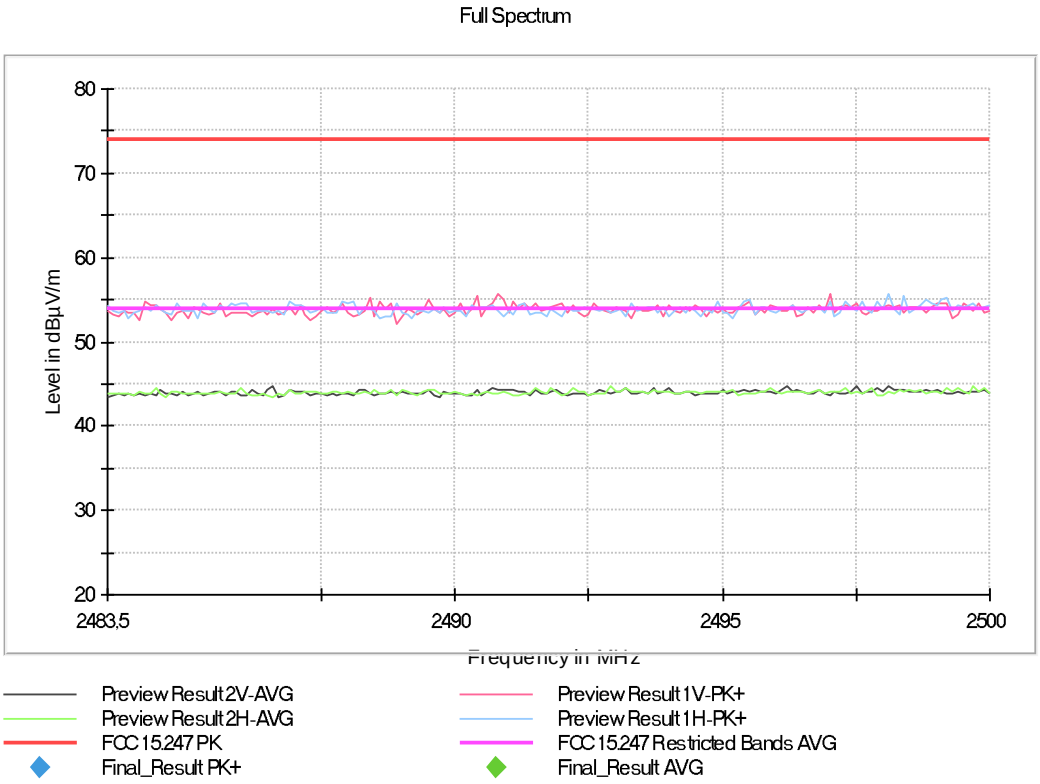

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 1 Mbit/s)
Frequency MHz = 2440.00000
MIMO Mode = SISO
Active Port = 1

Images:

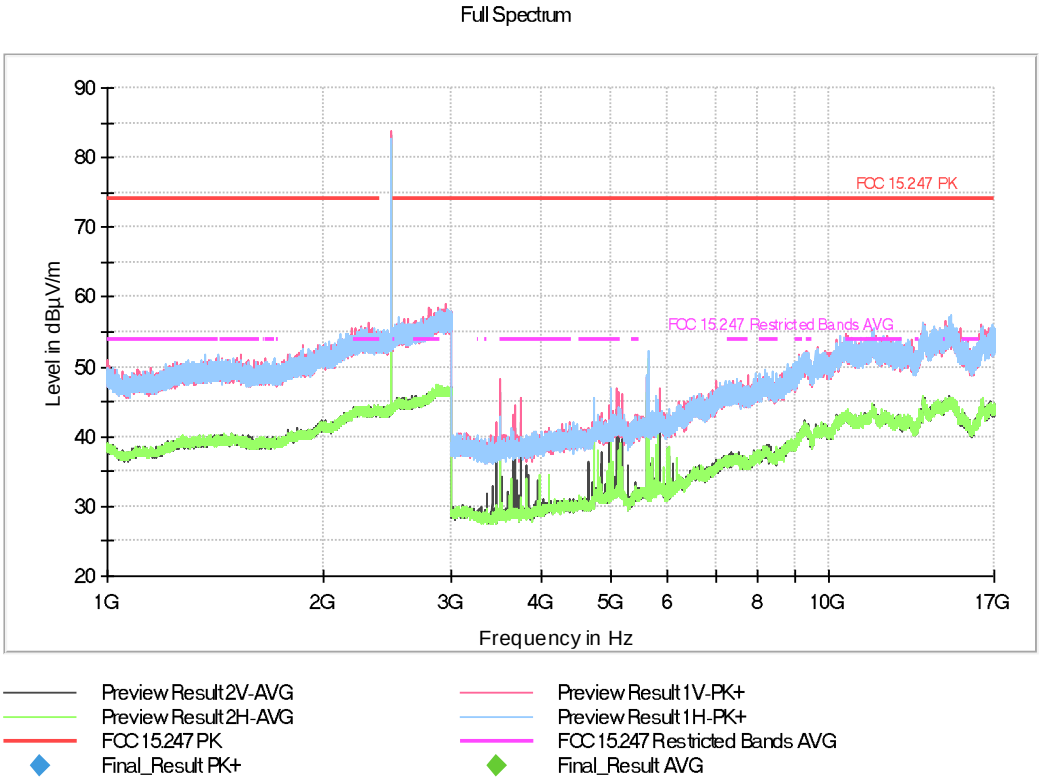


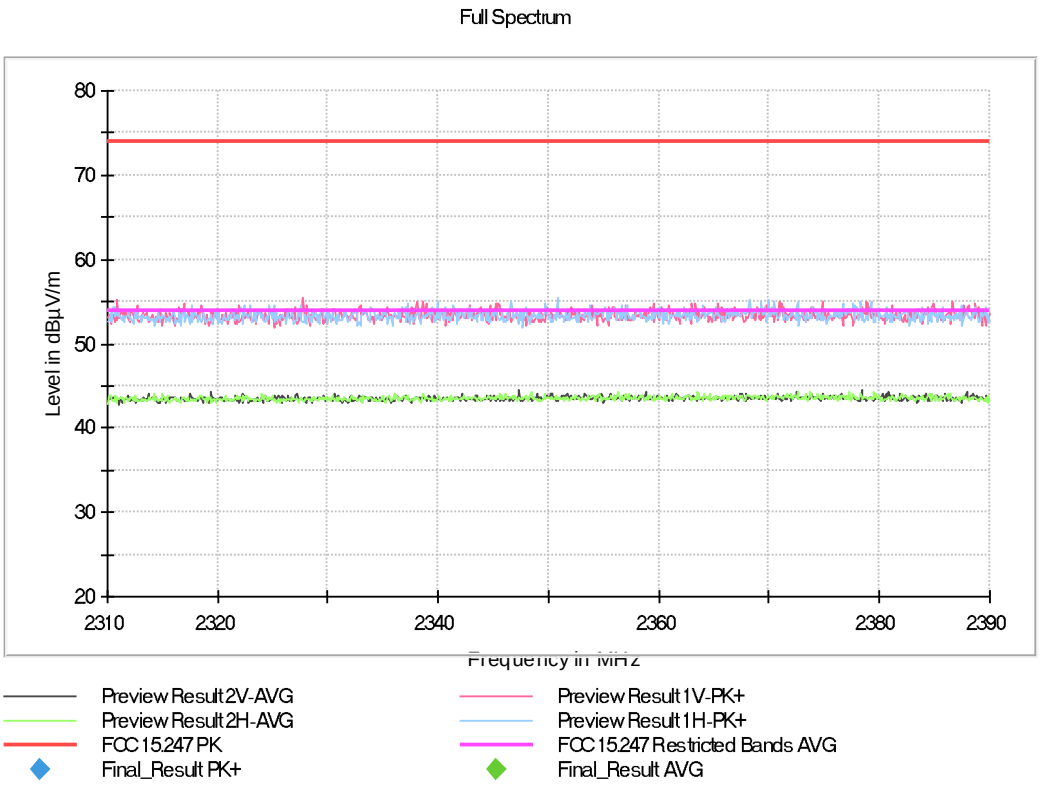


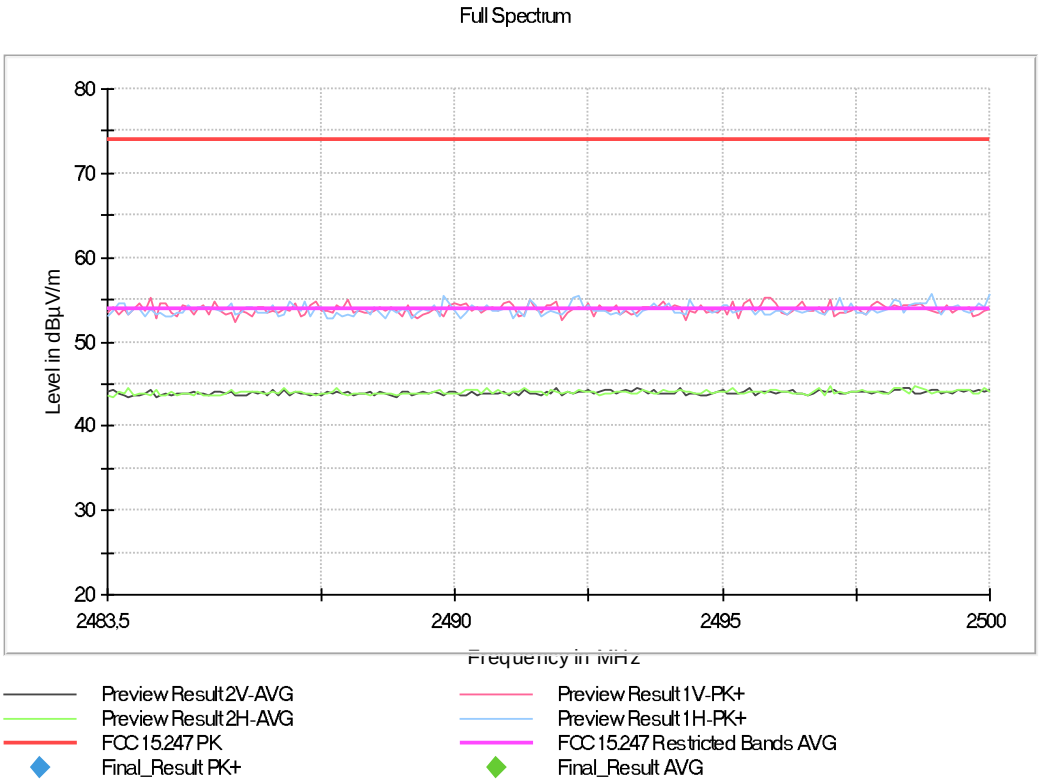

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 1 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
80
70
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2483,5
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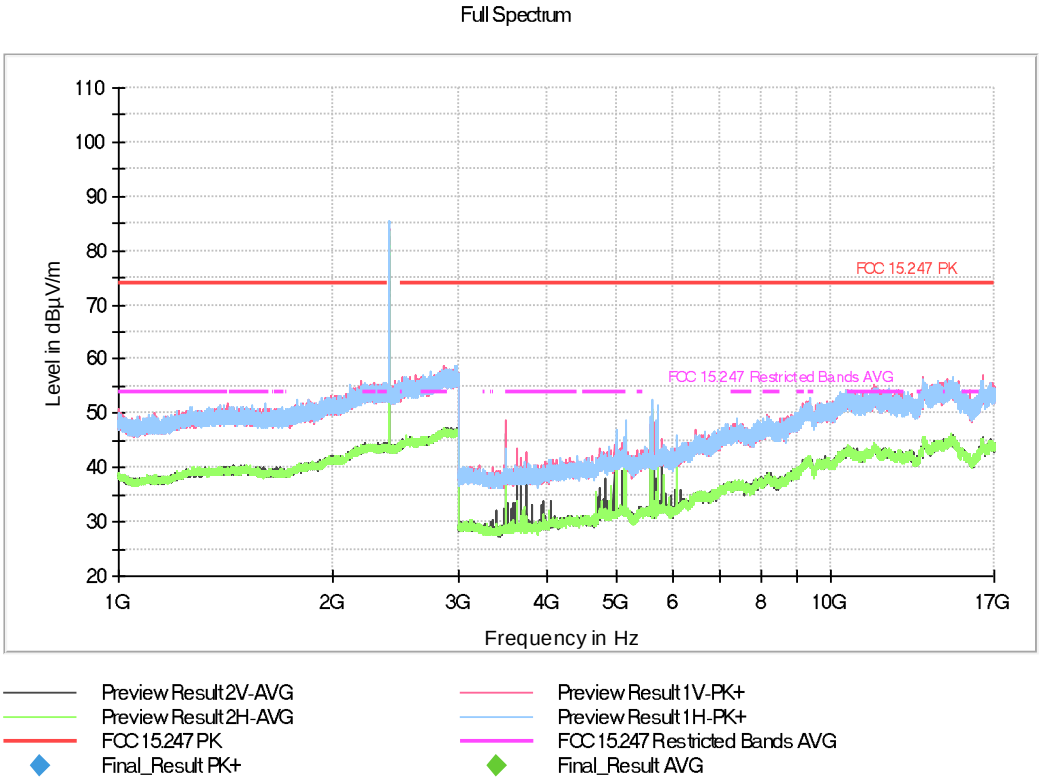
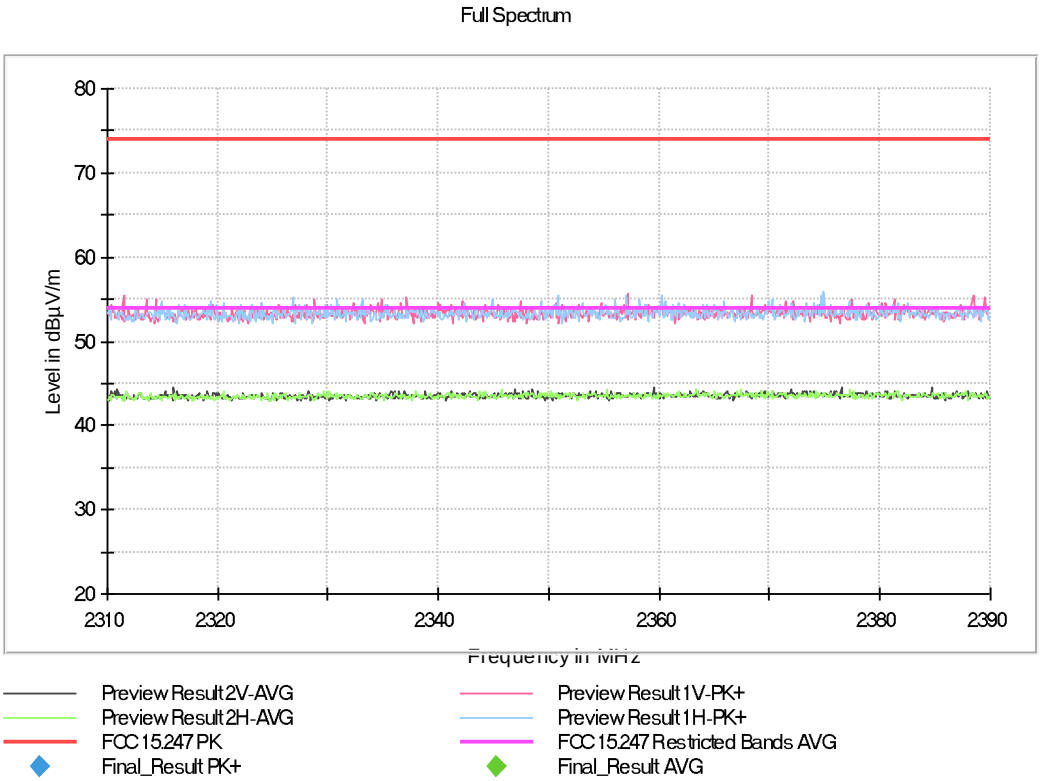
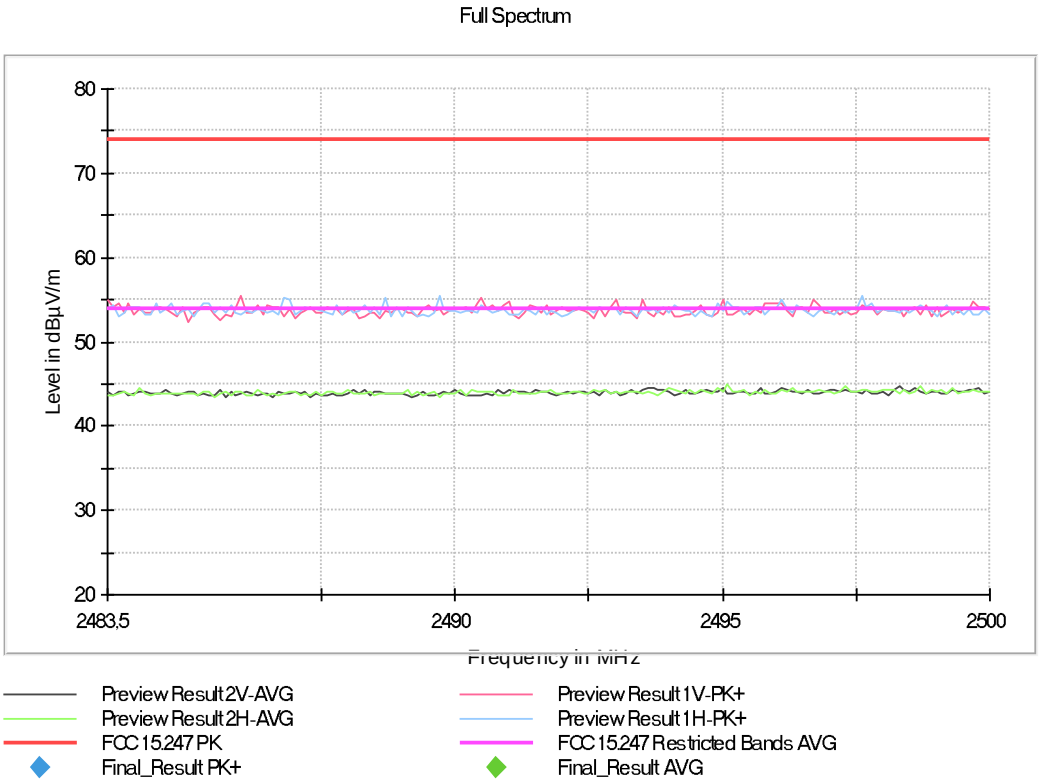
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 2 Mbit/s)
Frequency MHz = 2402.00000
MIMO Mode = SISO
Active Port = 1

Images:

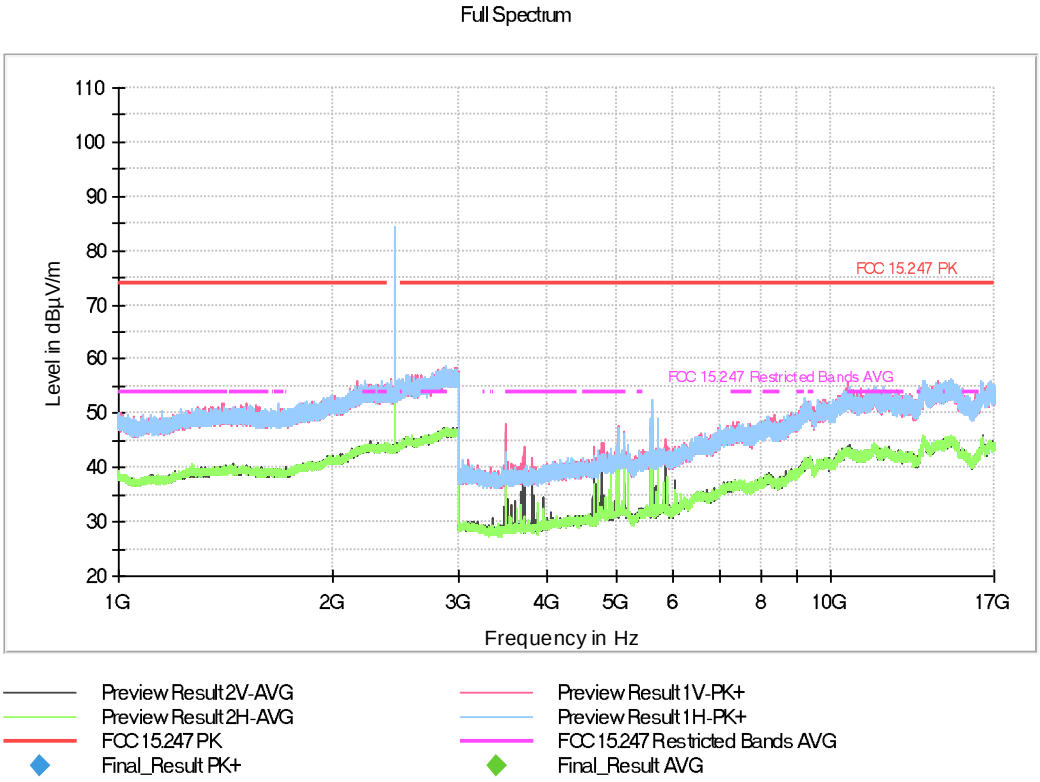


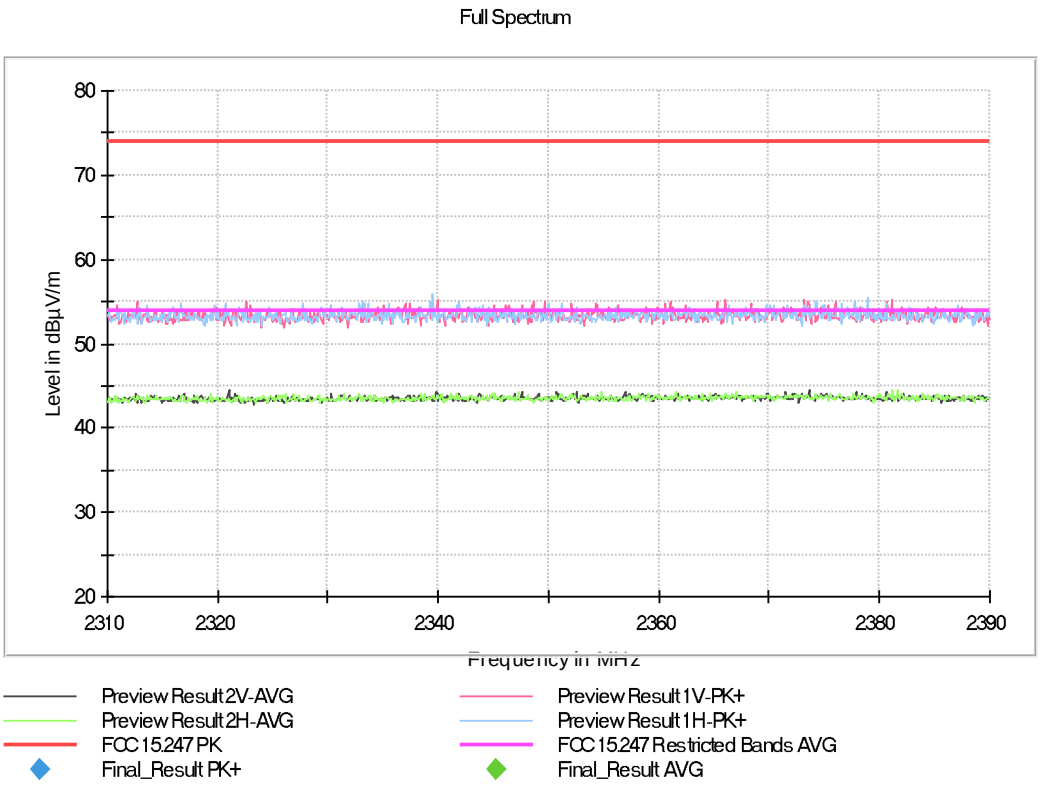


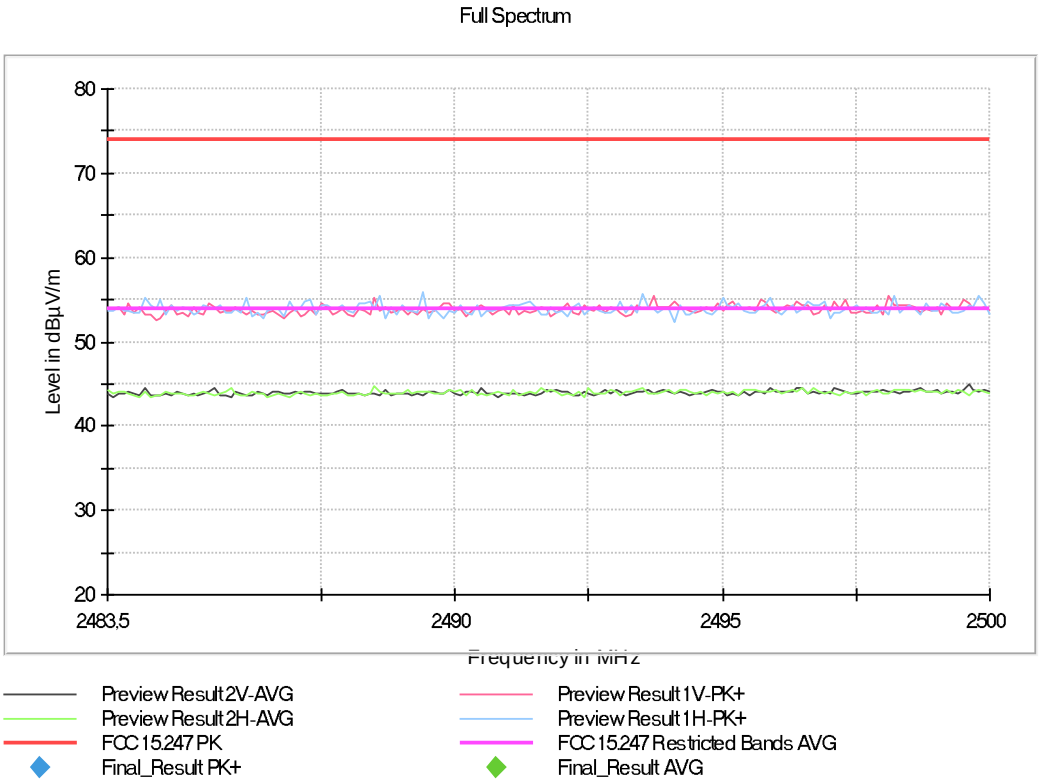

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 2 Mbit/s)
Frequency MHz = 2440.00000
MIMO Mode = SISO
Active Port = 1

Images:






Full Spectrum
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Preview Result 2V-AVG
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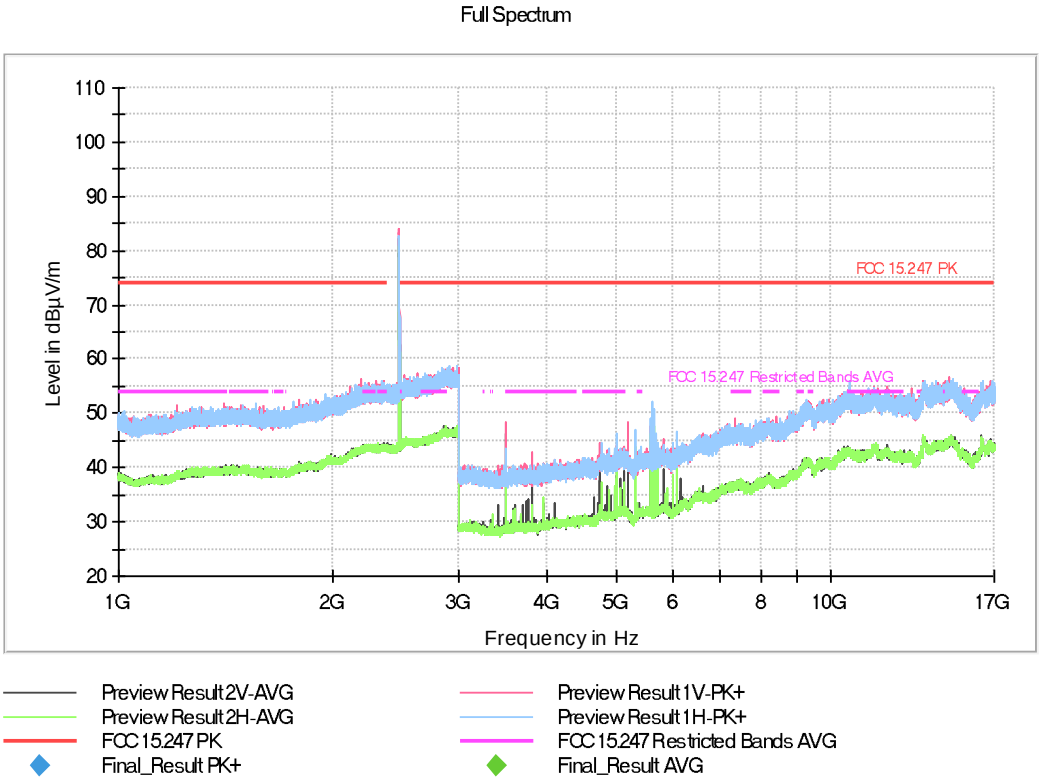
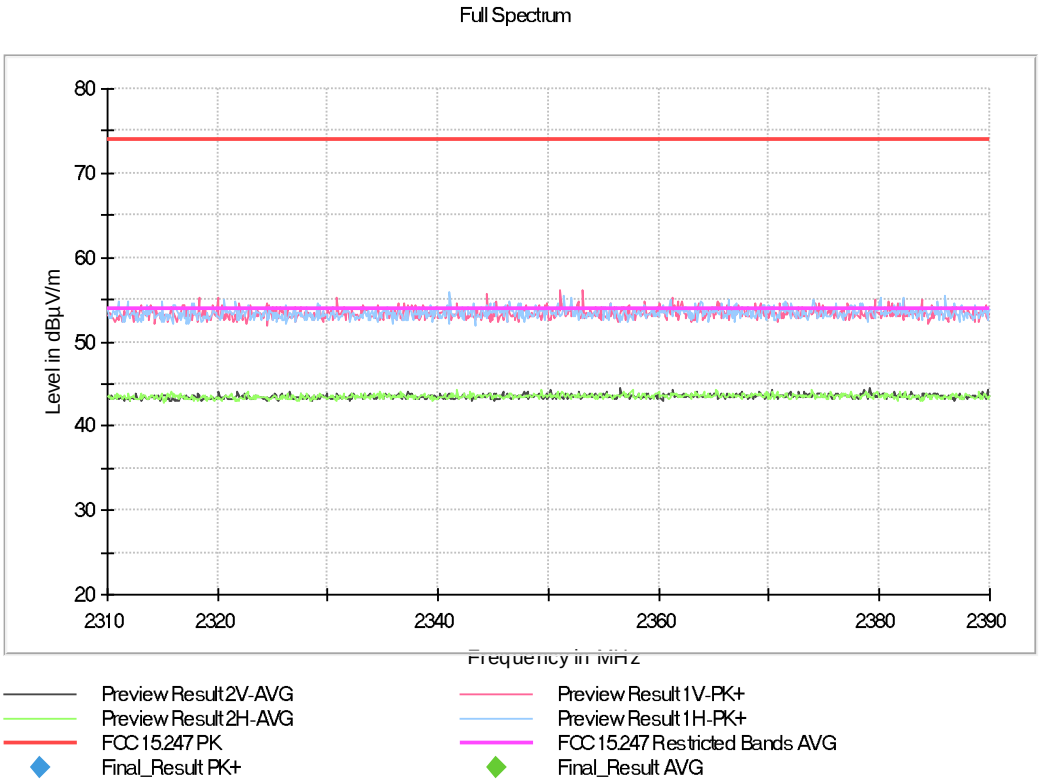
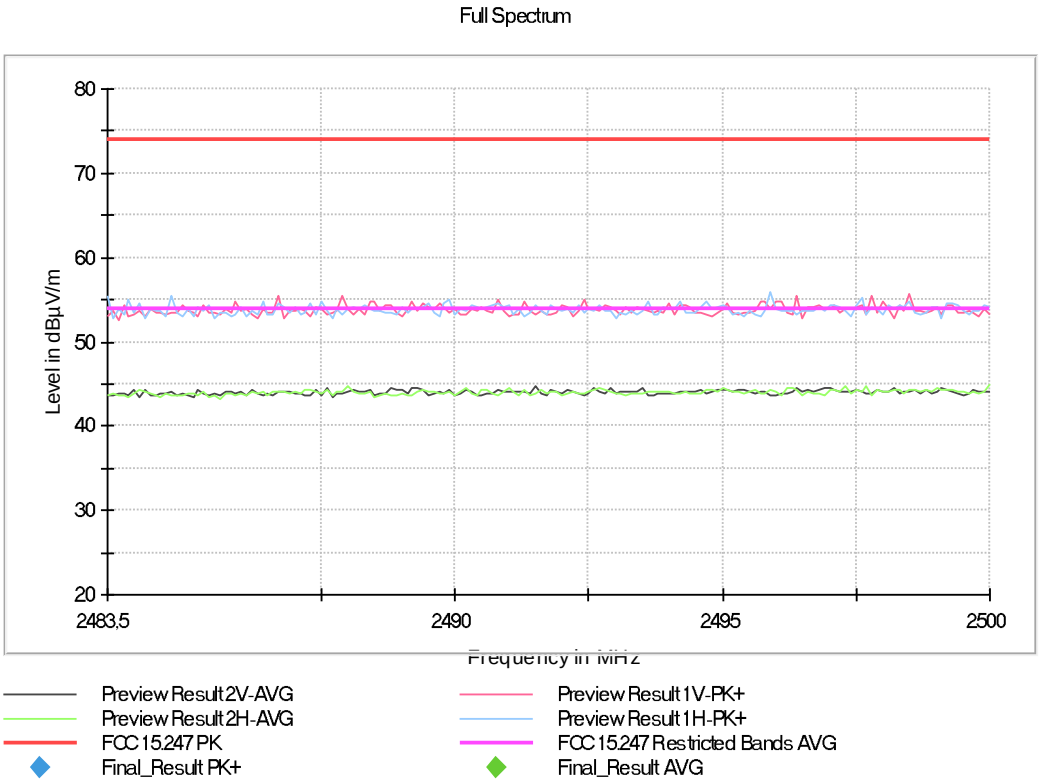
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = BTLE 5.0 (GFSK 2 Mbit/s)
Frequency MHz = 2480.00000
MIMO Mode = SISO
Active Port = 1

Images:







Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 2,39 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
2,39 GHz - 2,484 GHz	40 kHz	PK+	100 kHz	0,01 s	0 dB
2,484 GHz - 3 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
3 GHz - 17 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Frequency Range GHz = [17, 26]

Modulation = The spurious frequencies detected do not depend on the modulation.

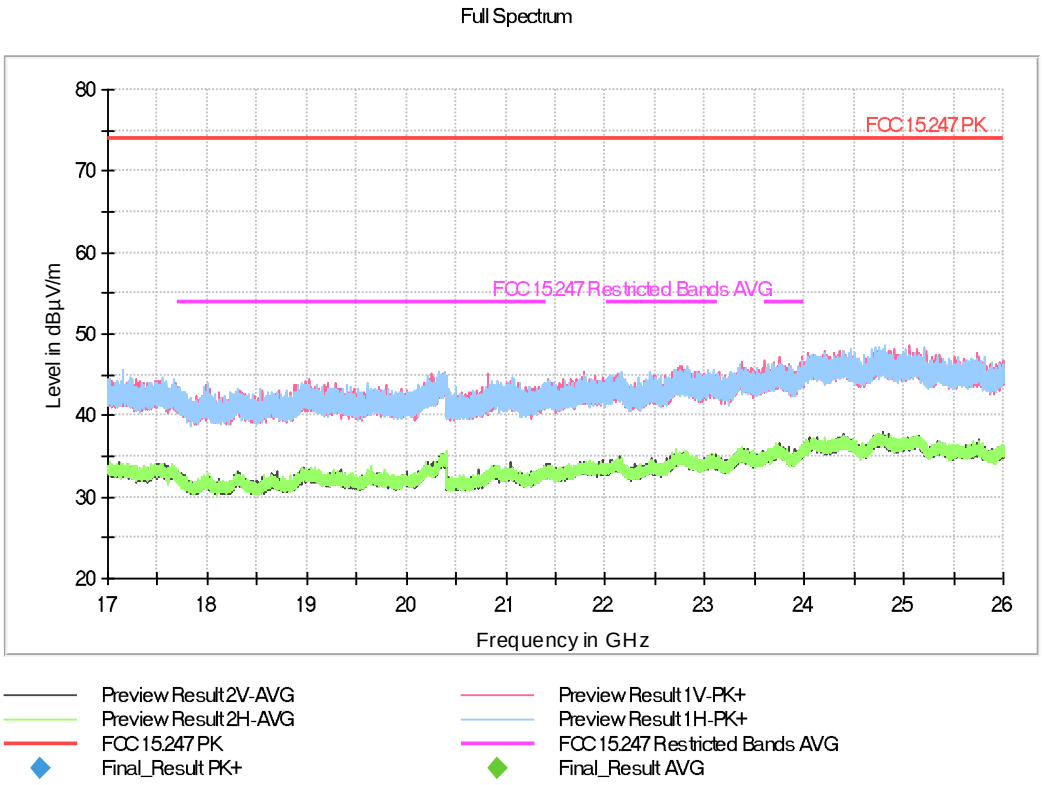
MIMO Mode = SISO

Equipment Type = Digital Transmission System (DTS)

Frequency MHz = The spurious frequencies detected do not depend on operating channel.

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
17 GHz - 26 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Appendix B: Test results. Bluetooth EDR

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RSS-247 5.4 (d) / FCC 15.247 (b) (1) Maximum Peak Conducted output power 41

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	12 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Technology	Antenna Gain	Type
BTEDR:	+0.1 dBi	External

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel
BTEDR GFSK	1-DH5	2402 MHz	2441 MHz	2480 MHz
BTEDR PI/4 DQPSK	2-DH5	2402 MHz	2441 MHz	2480 MHz
BTEDR 8DPSK	3-DH5	2402 MHz	2441 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

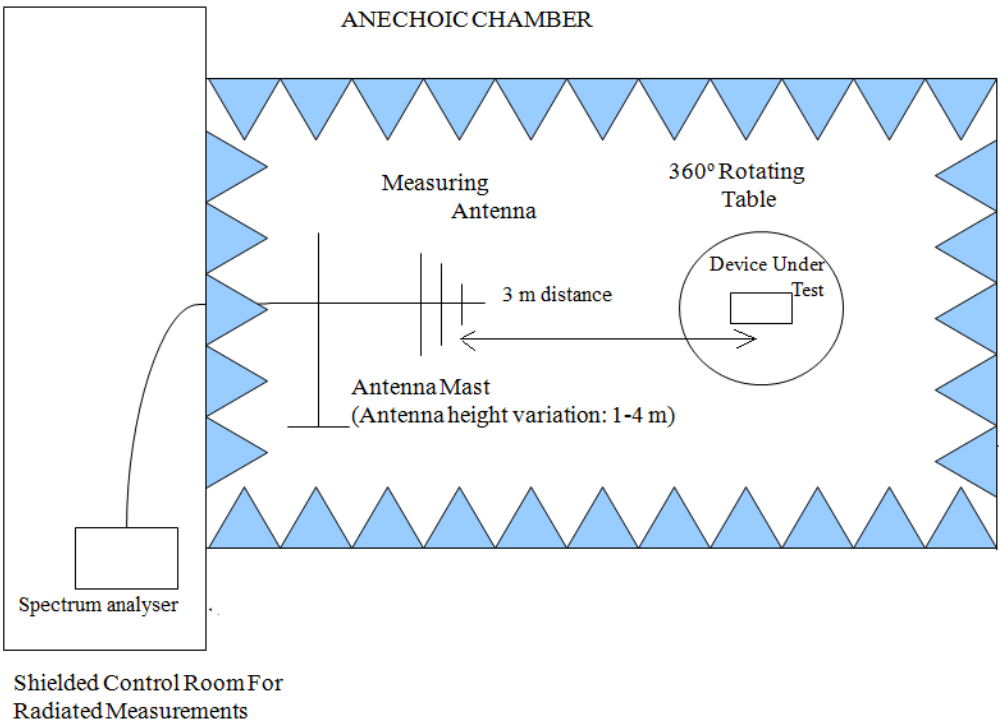
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

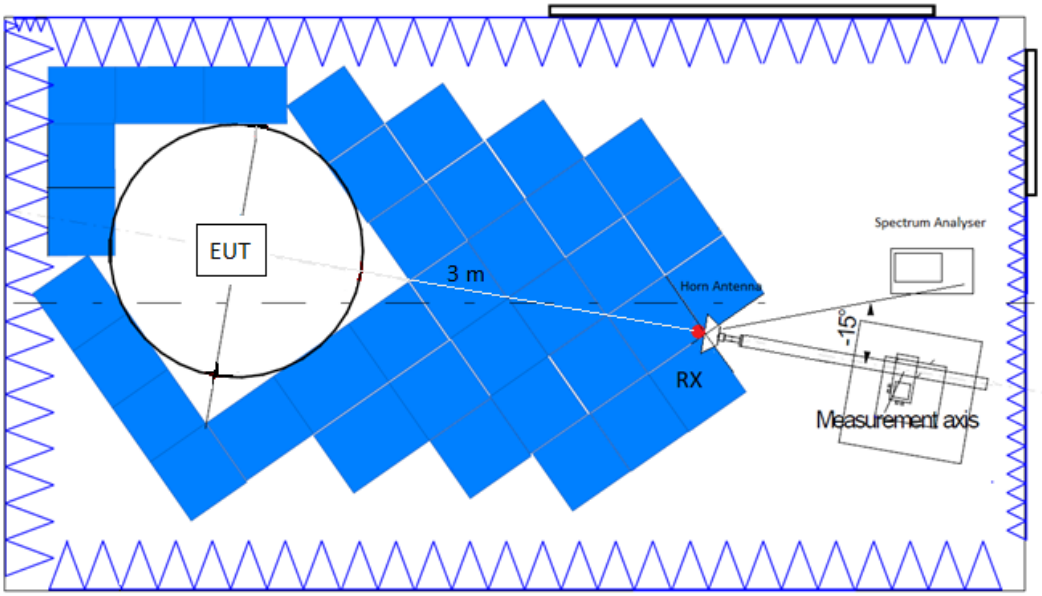
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

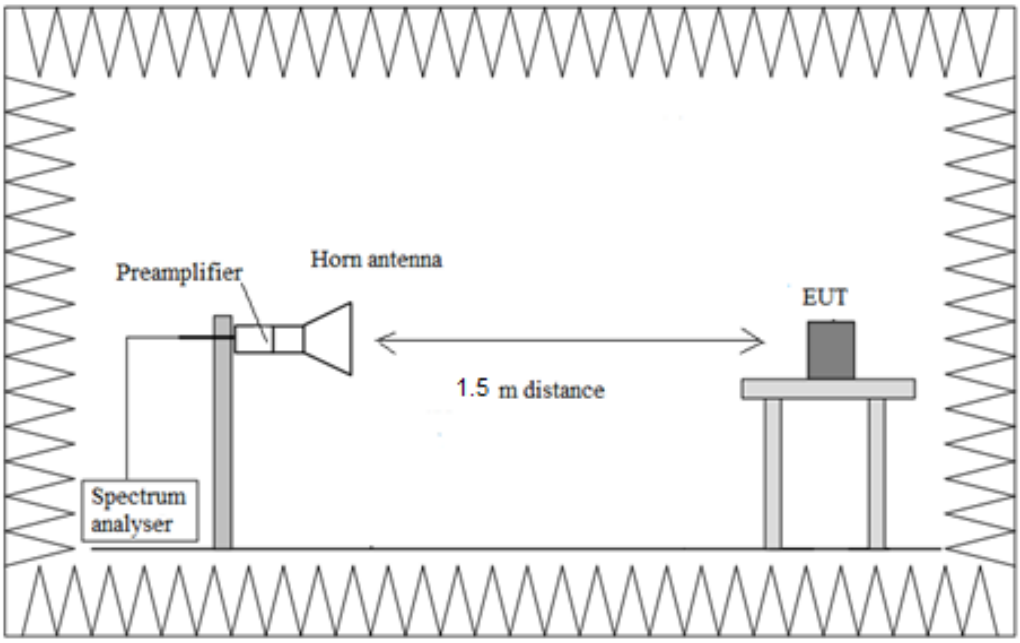
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 5.4 (d) / FCC 15.247 (b) (1) Maximum Peak Conducted output power

Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (RSS-247).

The maximum peak conducted output power level of the fundamental emission was measured according to clause 7.8.5 “Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices” of ANSI C63.10-2013.

Results

Worst case channel and modulation only.

Modulation: BT (8DPSK 3-DH5)

Freq (MHz)	Peak Power (dBm)	Maximum EIRP Power (dBm)
2402.00000	-6.319	-6.219

Verdict

Pass

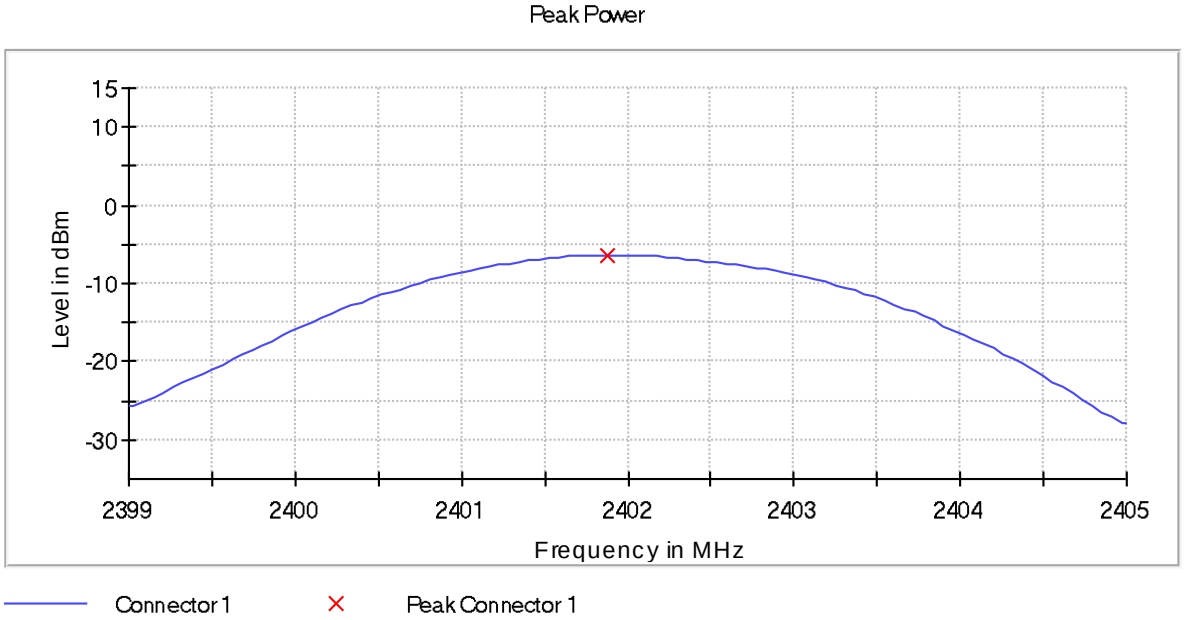
Attachments

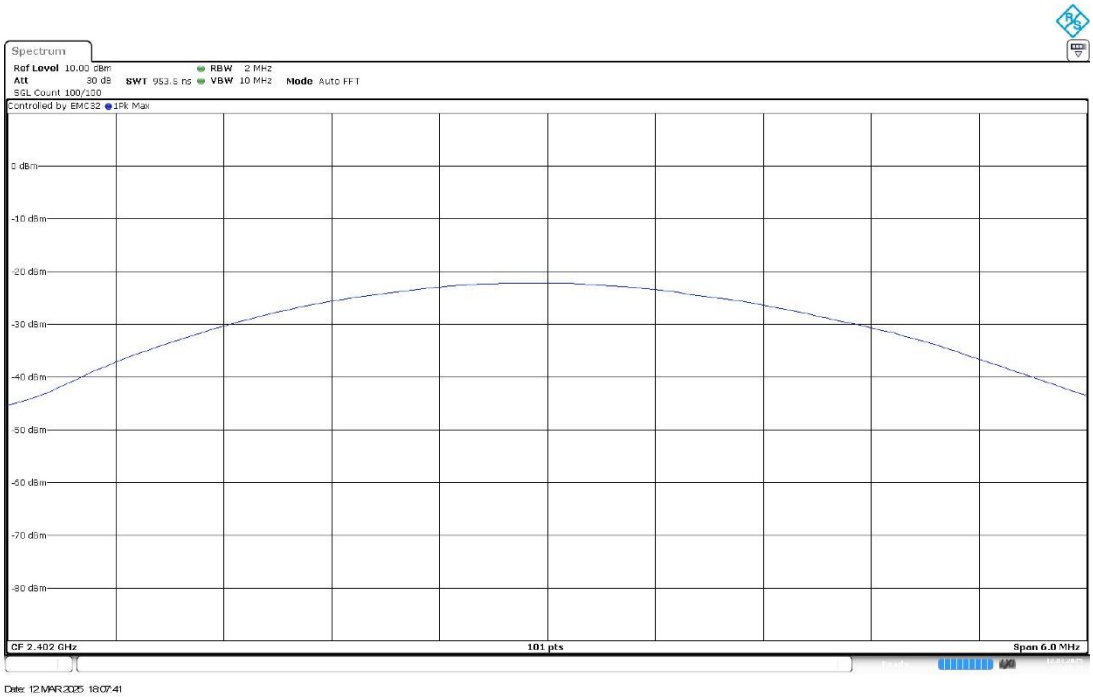
Equipment Type = Frequency Hopping Spread Spectrum systems (DSS) Bandwidth MHz = 1

Modulation = BT (8DPSK 3-DH5) Frequency MHz = 2402.00000

Antenna configuration = SISO Active Port = 1

Images:





RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)

Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.
Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Results

Modulation: The spurious frequencies detected do not depend on either the modulation or the operating channel.

Freq Rng (GHz)	Equipment	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[0.03, 1]	Frequency Hopping Spread Spectrum systems (DSS)	1	37.372	21.56	H	PK
				19.30	H	QP
			65.308	14.08	V	PK
				11.65	V	QP
			79.518	24.72	V	PK
				21.14	V	QP
			600.021	30.39	V	PK
				27.43	V	QP

Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

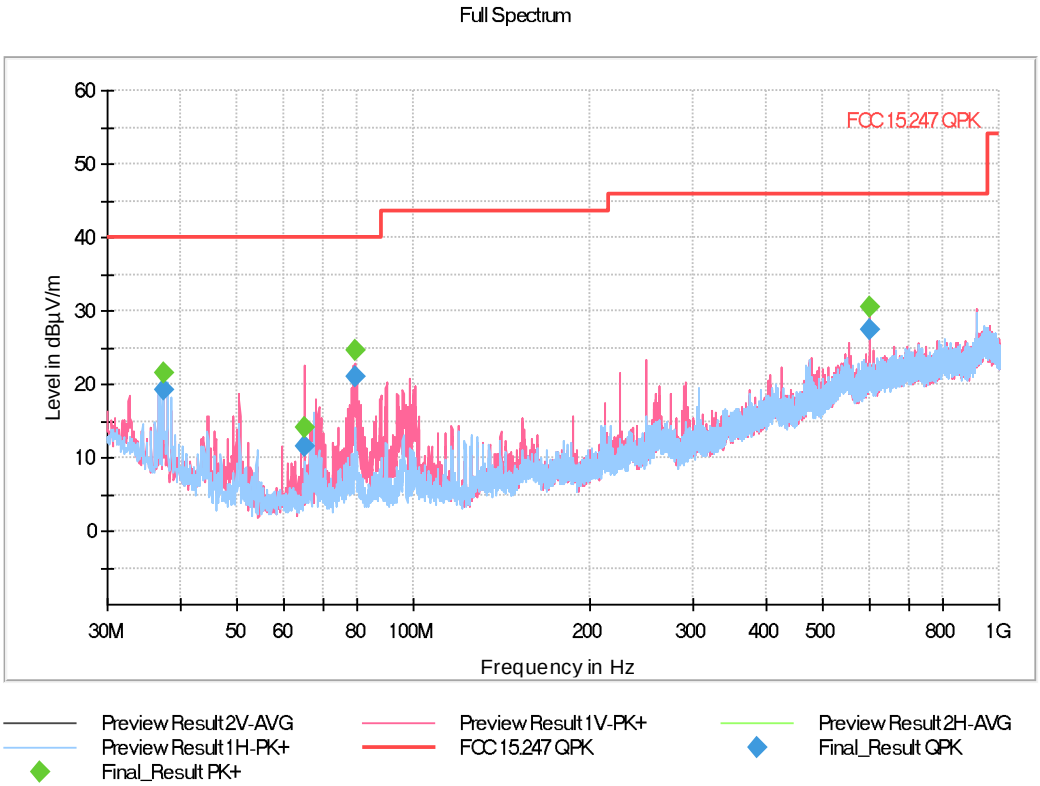
Modulation = The spurious frequencies detected do not depend on the modulation.

Frequency MHz = The spurious frequencies detected do not depend on operating channel.

MIMO Mode = SISO

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

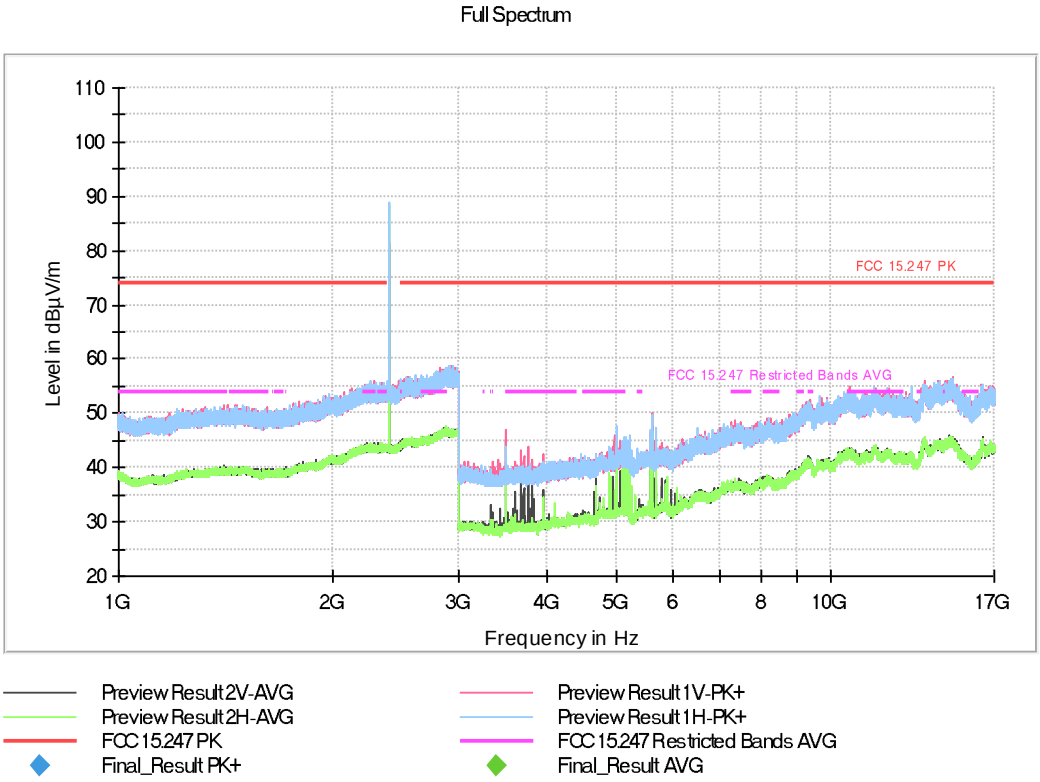
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	0 dB

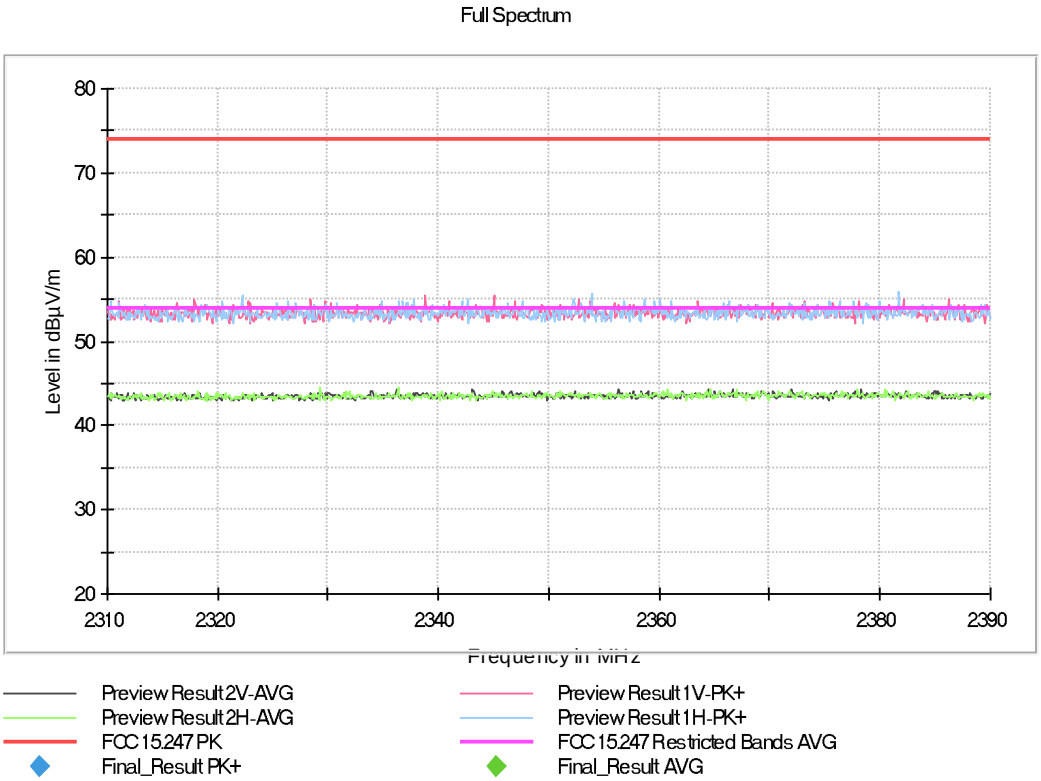
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

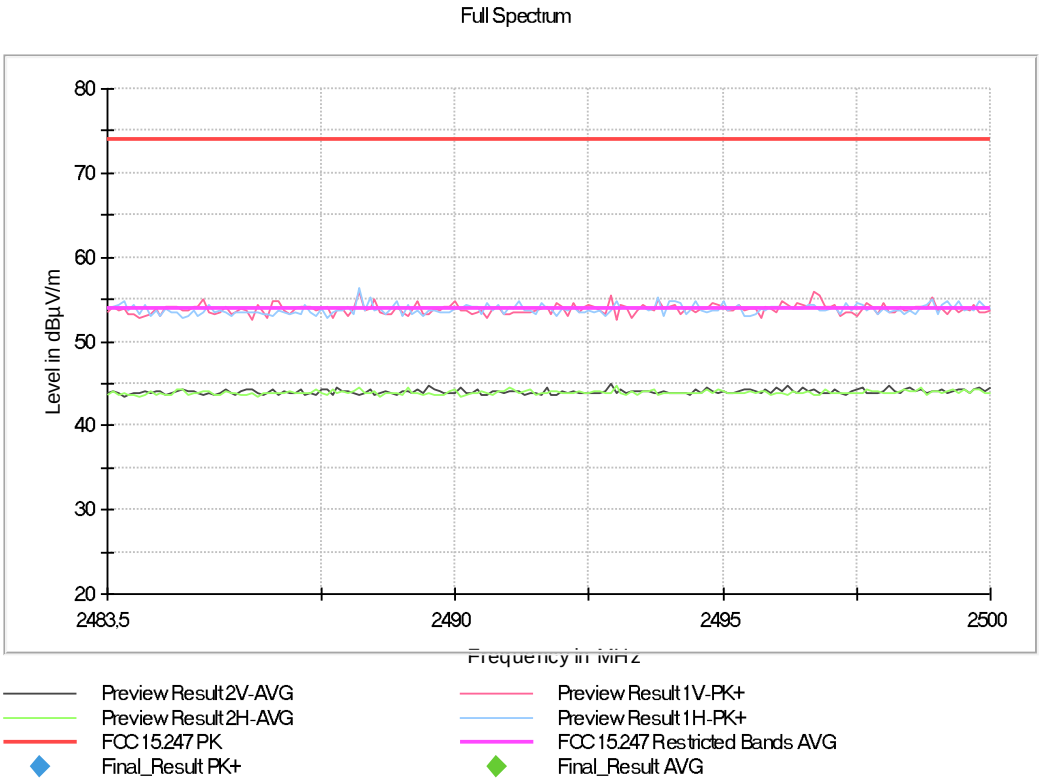
Modulation = BT (GFSK 1-DH5) Frequency MHz = 2402.00000

MIMO Mode = SISO Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
80
70
60
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40
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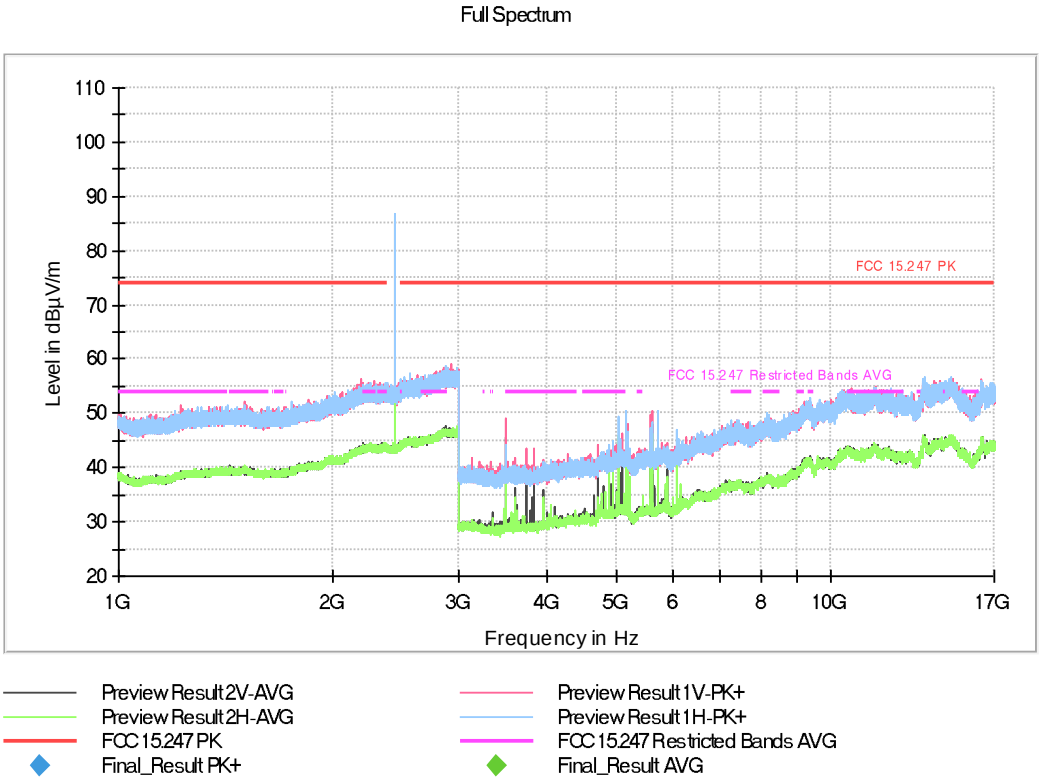
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

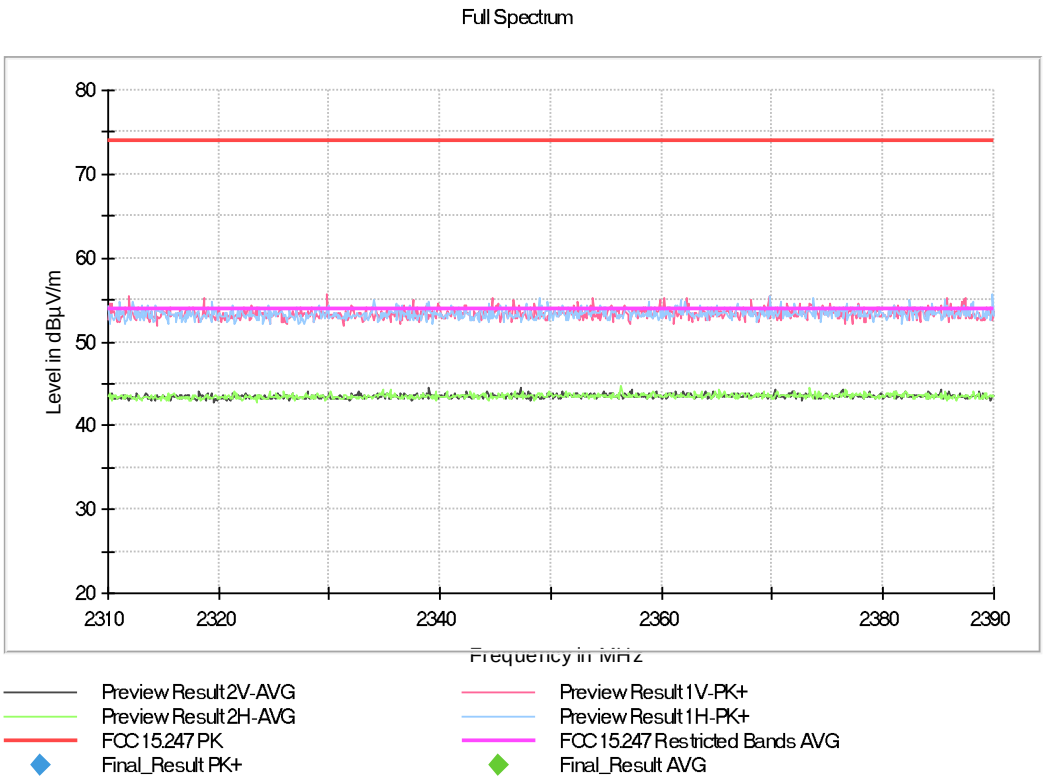
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

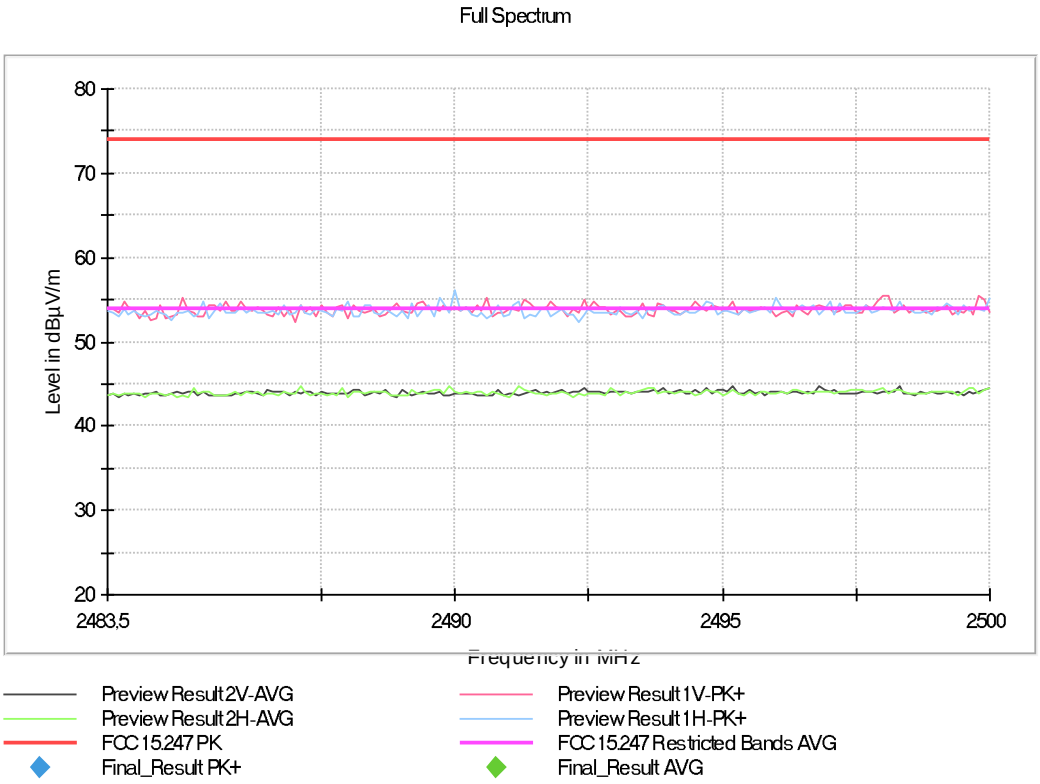
Modulation = BT (GFSK 1-DH5) Frequency MHz = 2441.00000

MIMO Mode = SISO Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
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20
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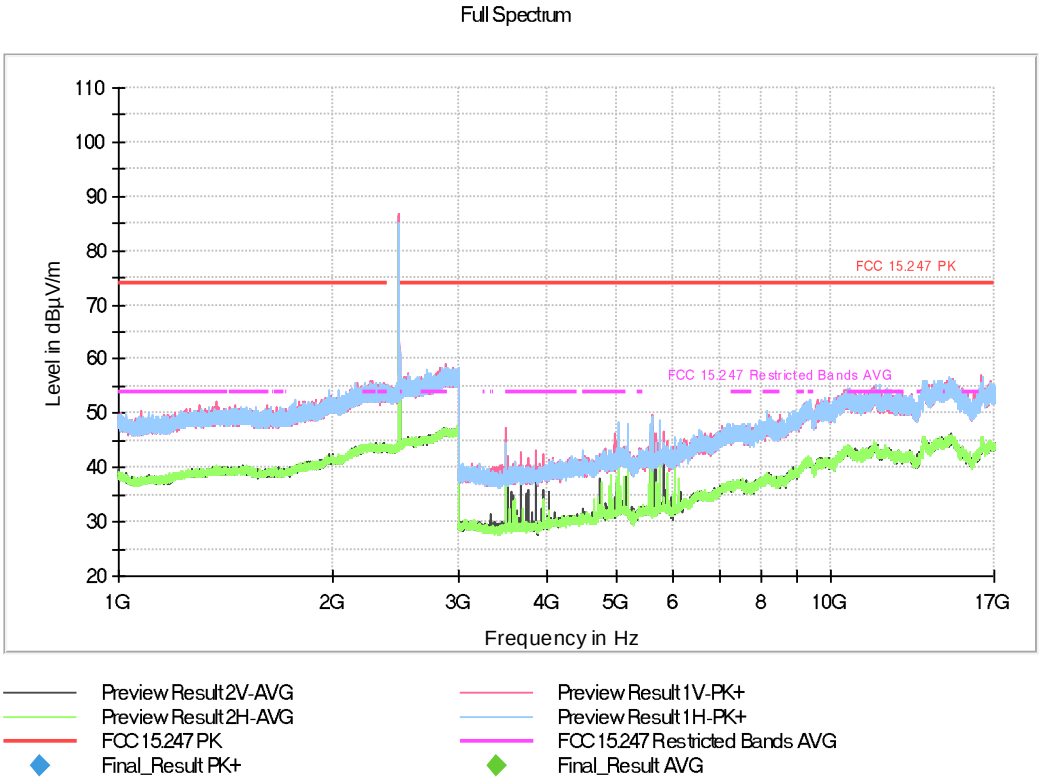
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

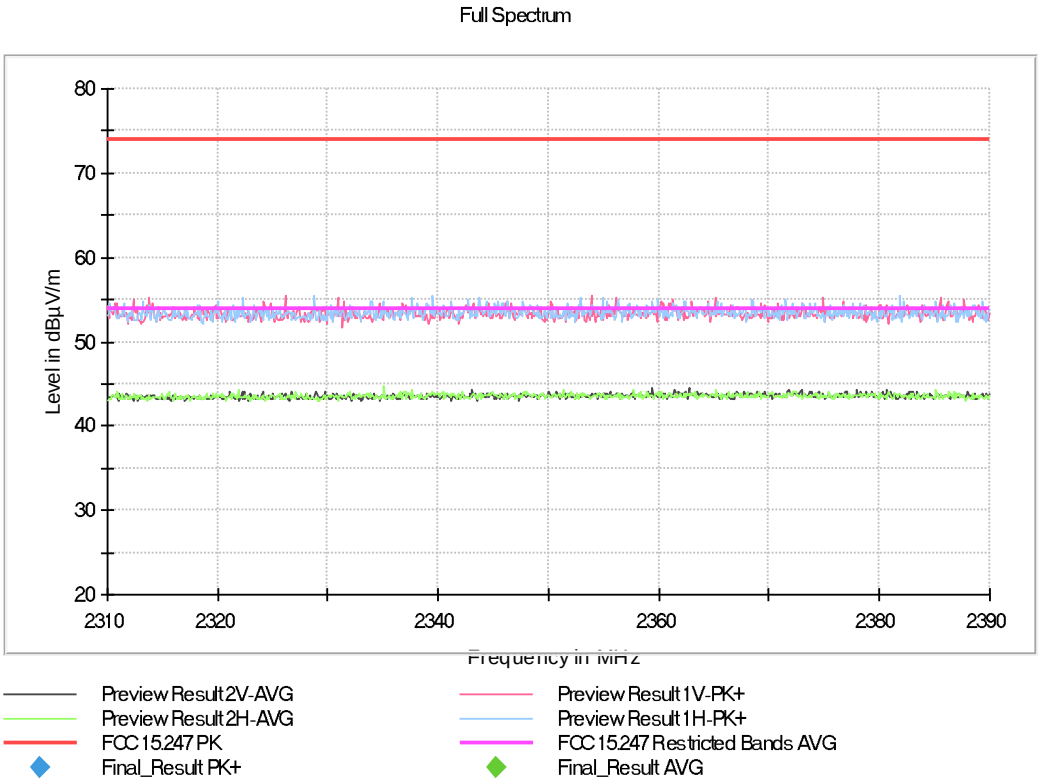
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

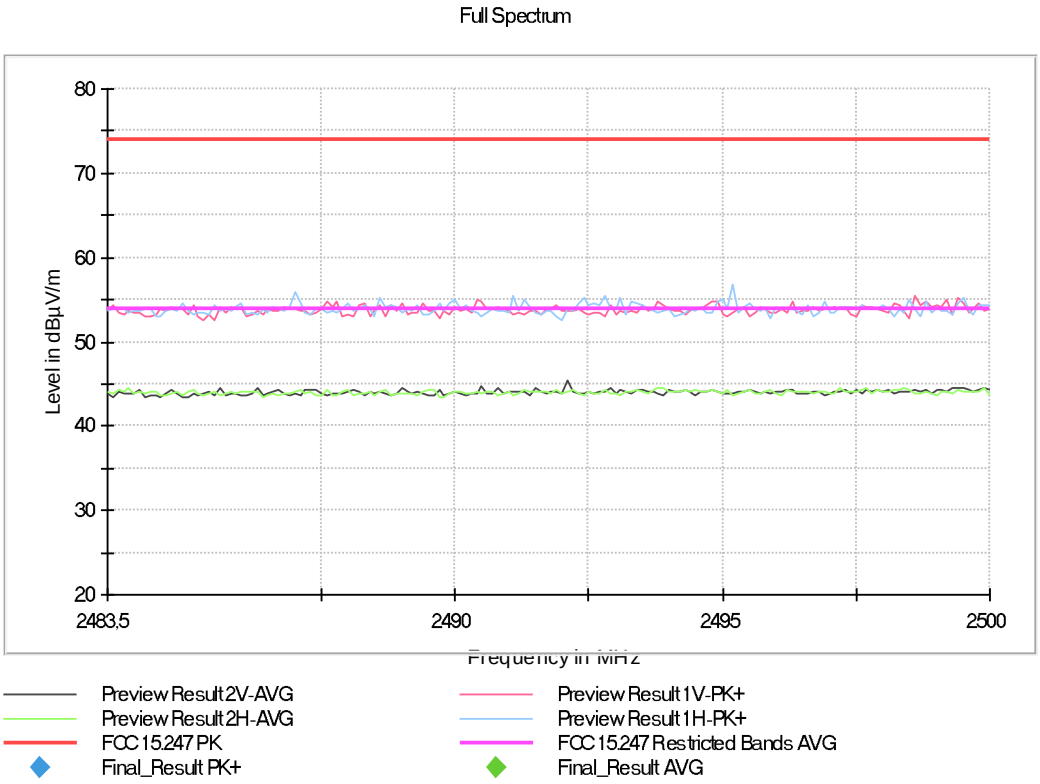
Modulation = BT (GFSK 1-DH5) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
80
70
60
50
40
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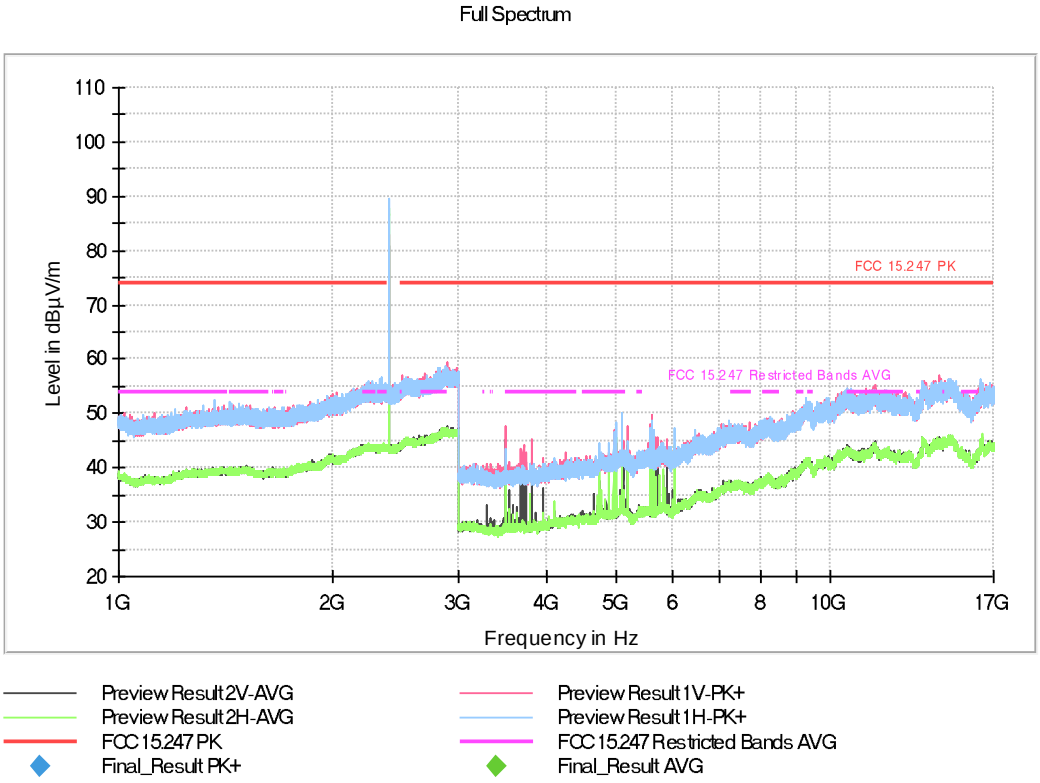
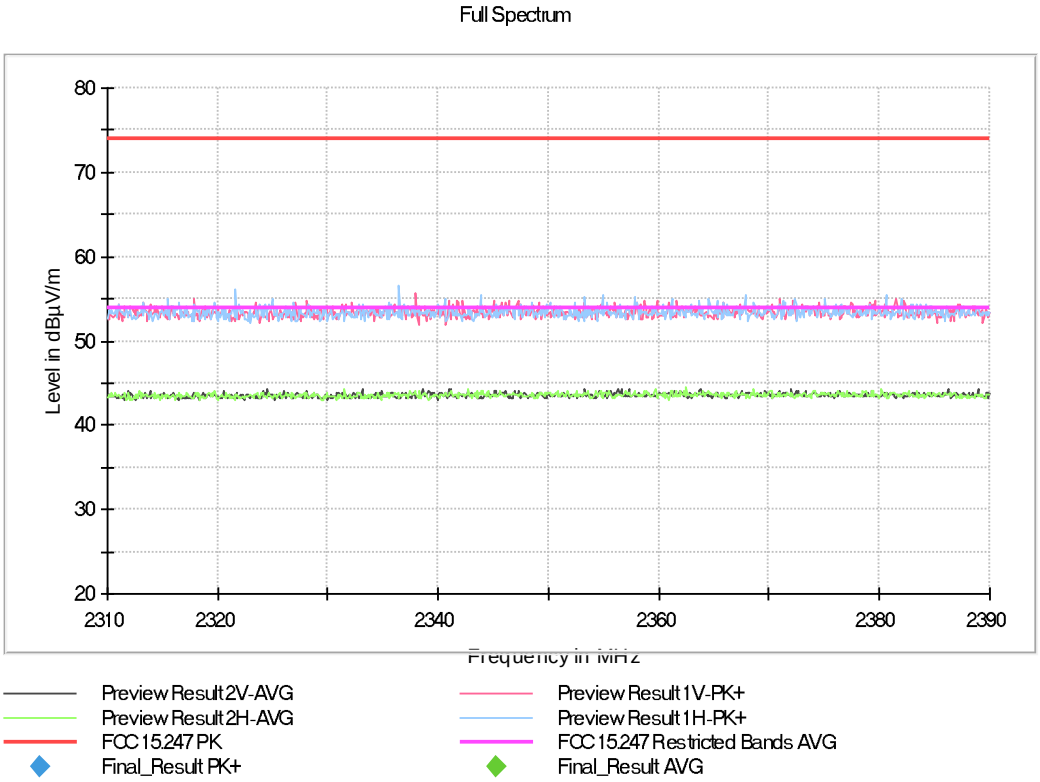
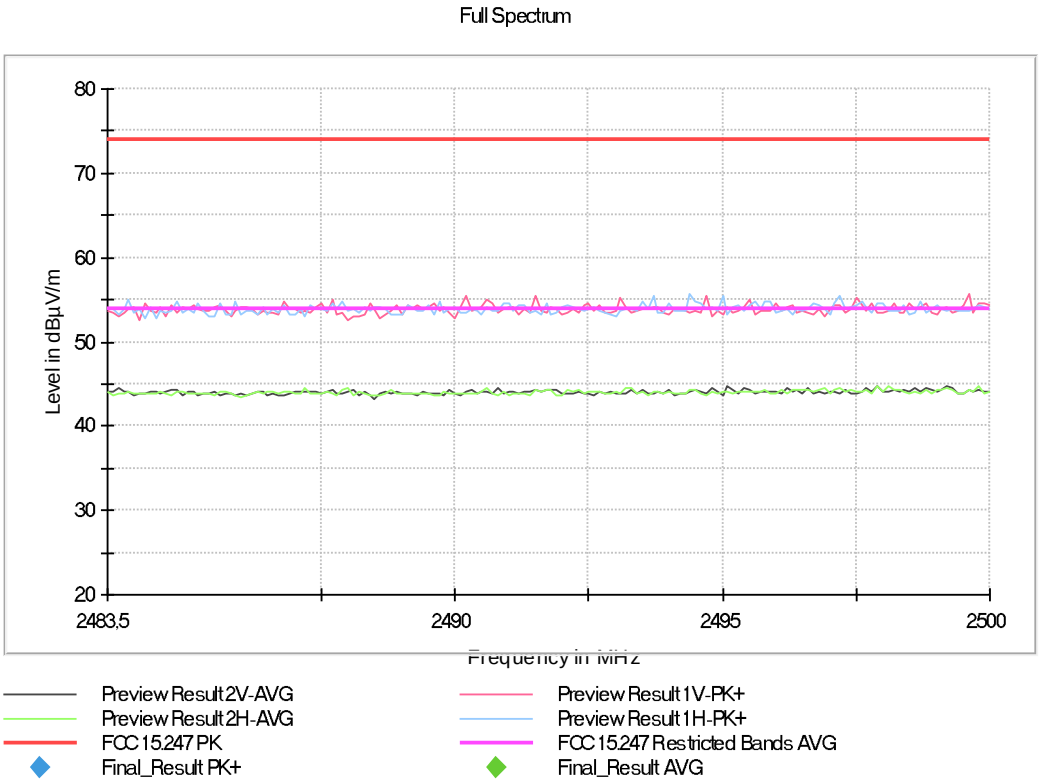
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]	Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)
Modulation = BT (Pi/4 DQPSK 2-DH5)	Frequency MHz = 2402.00000
MIMO Mode = SISO	Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
80
70
60
50
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30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

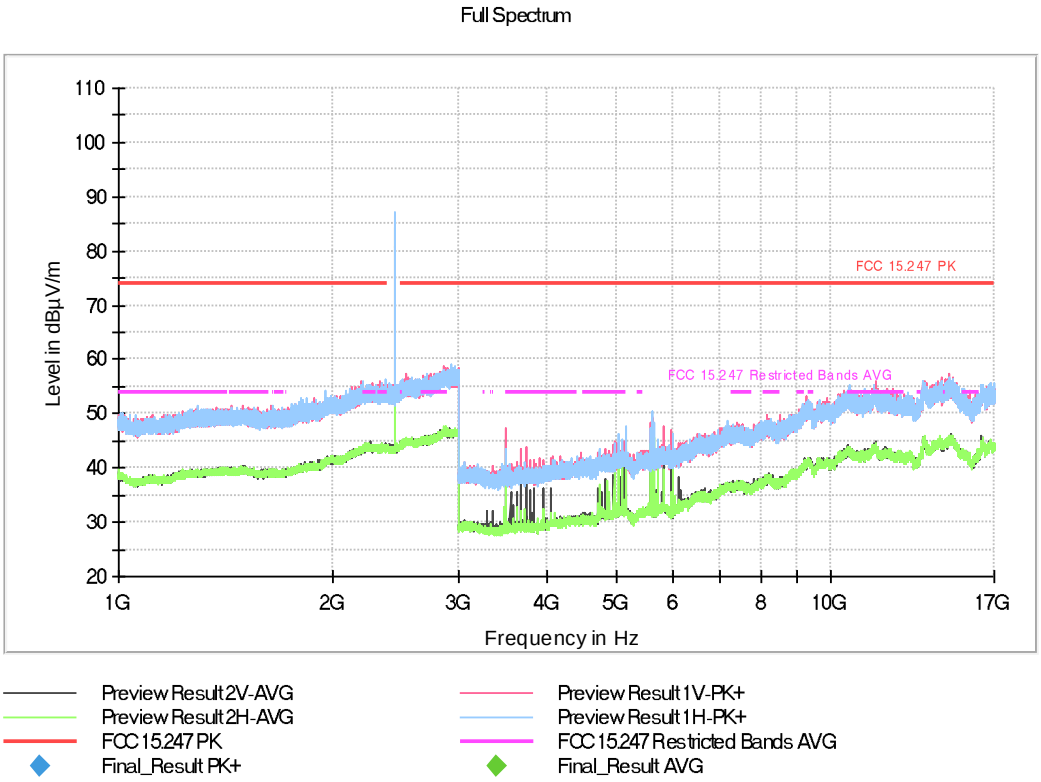
Modulation = BT (Pi/4 DQPSK 2-DH5)

Frequency MHz = 2441.00000

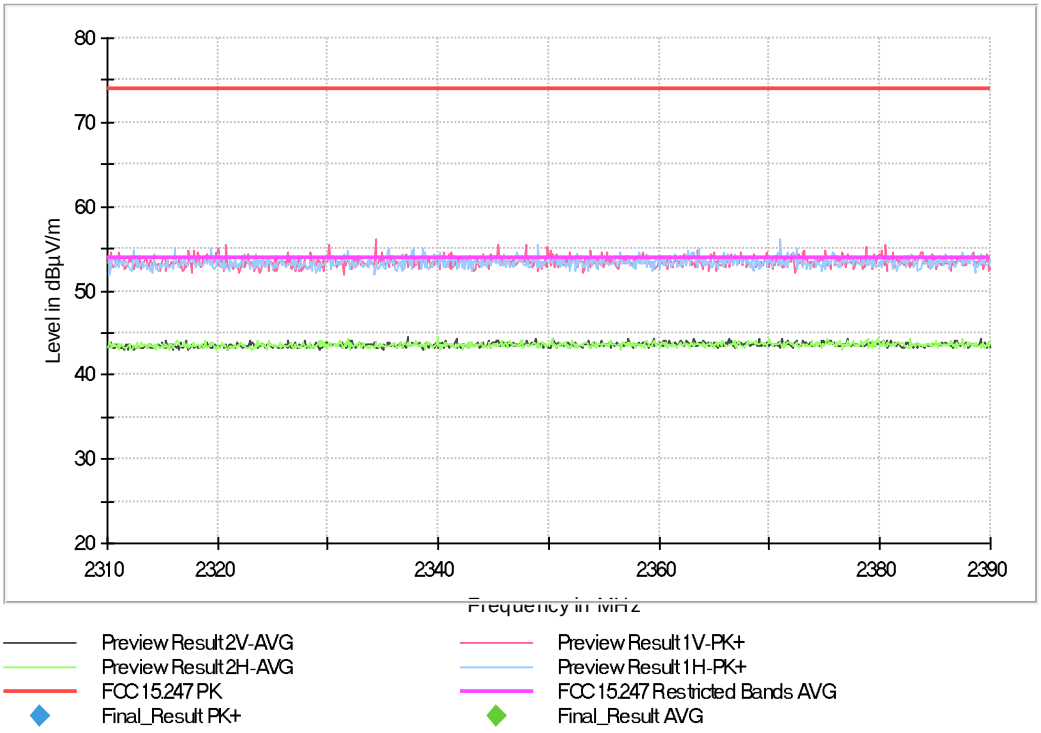
MIMO Mode = SISO

Active Port = 1

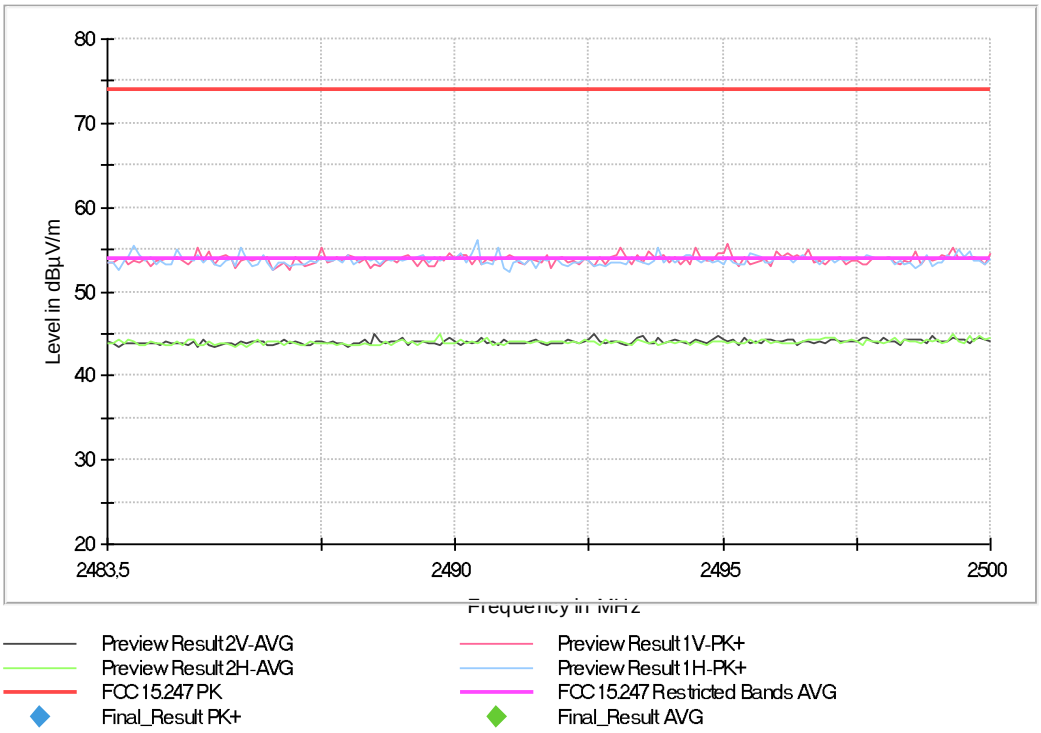
Images:



Full Spectrum

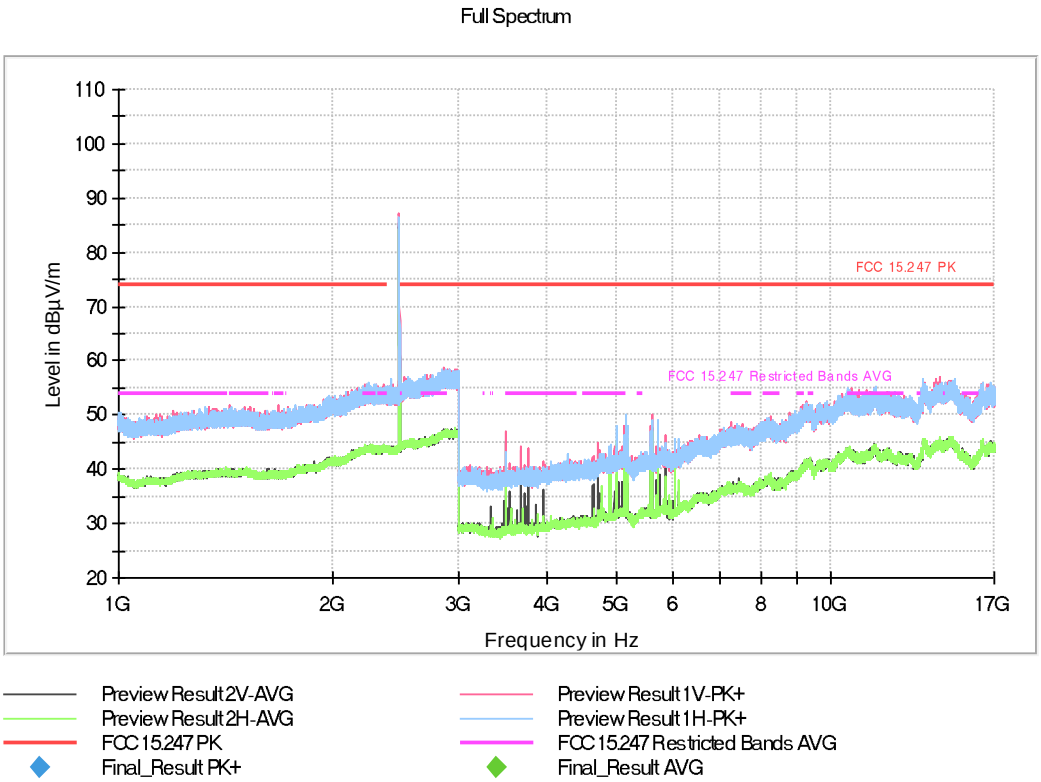


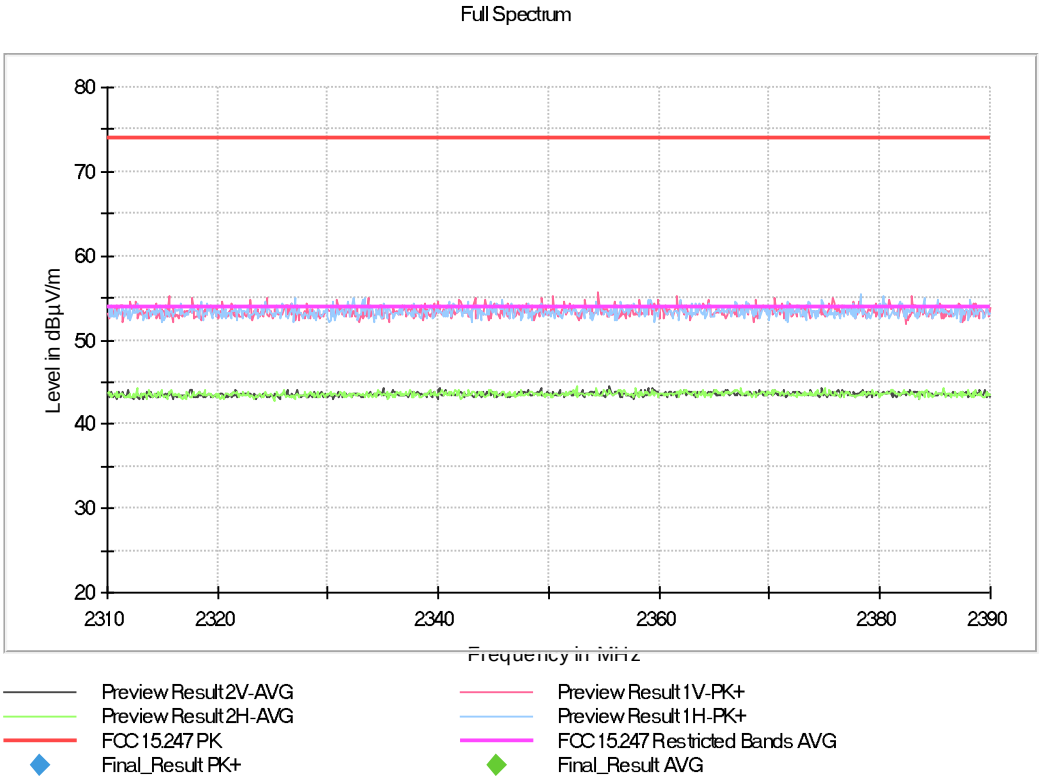
Full Spectrum

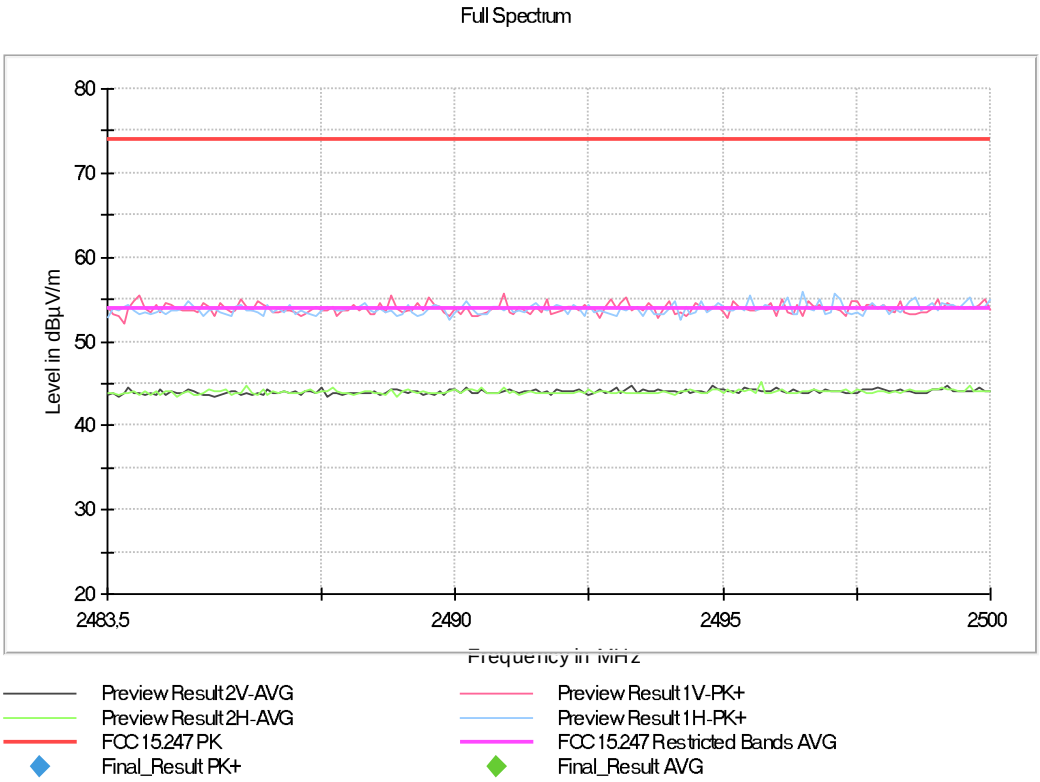


Frequency Range GHz = [1, 17]	Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)
Modulation = BT (Pi/4 DQPSK 2-DH5)	Frequency MHz = 2480.00000
MIMO Mode = SISO	Active Port = 1

Images:





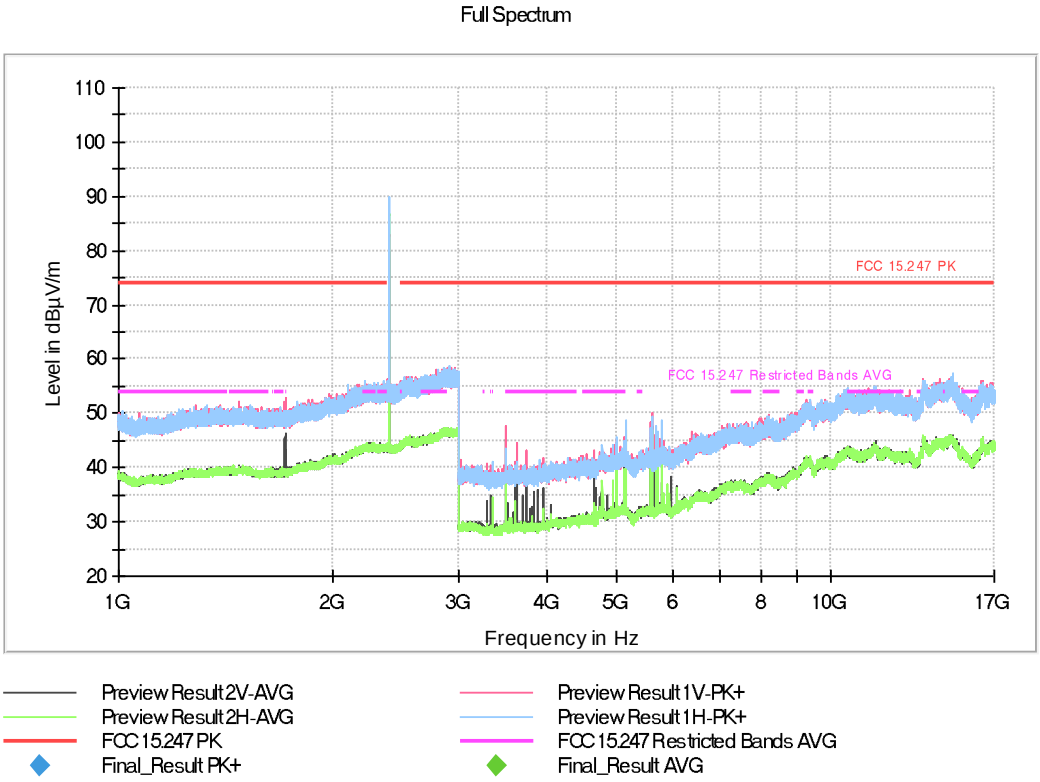

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

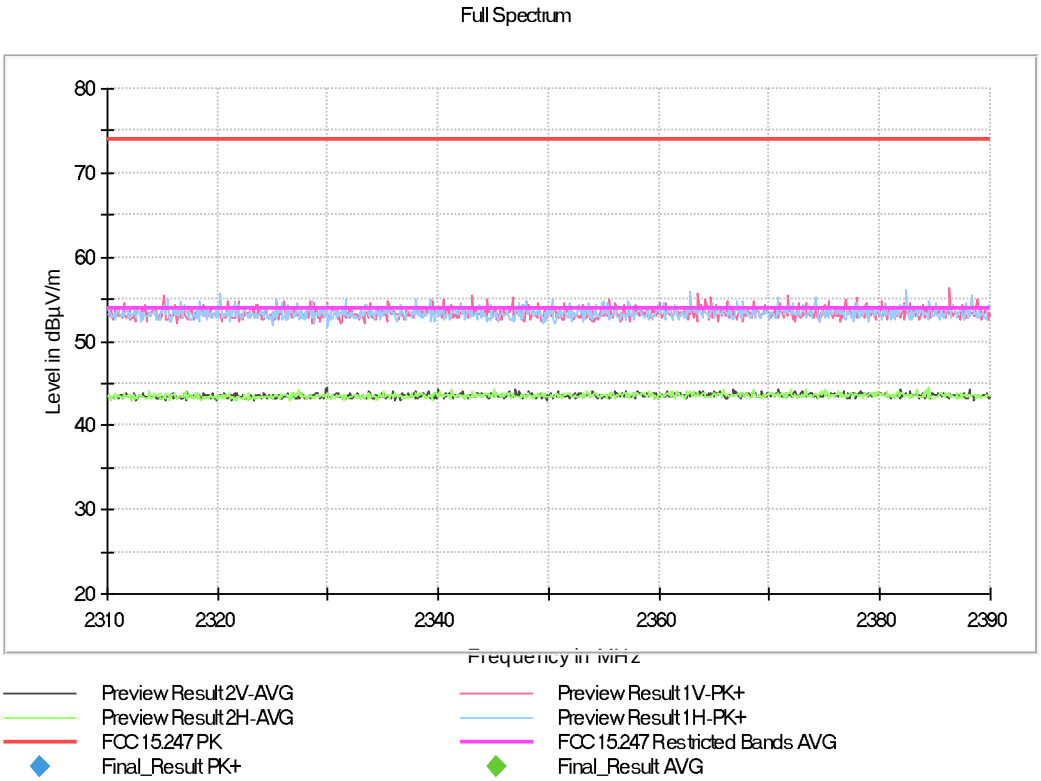
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

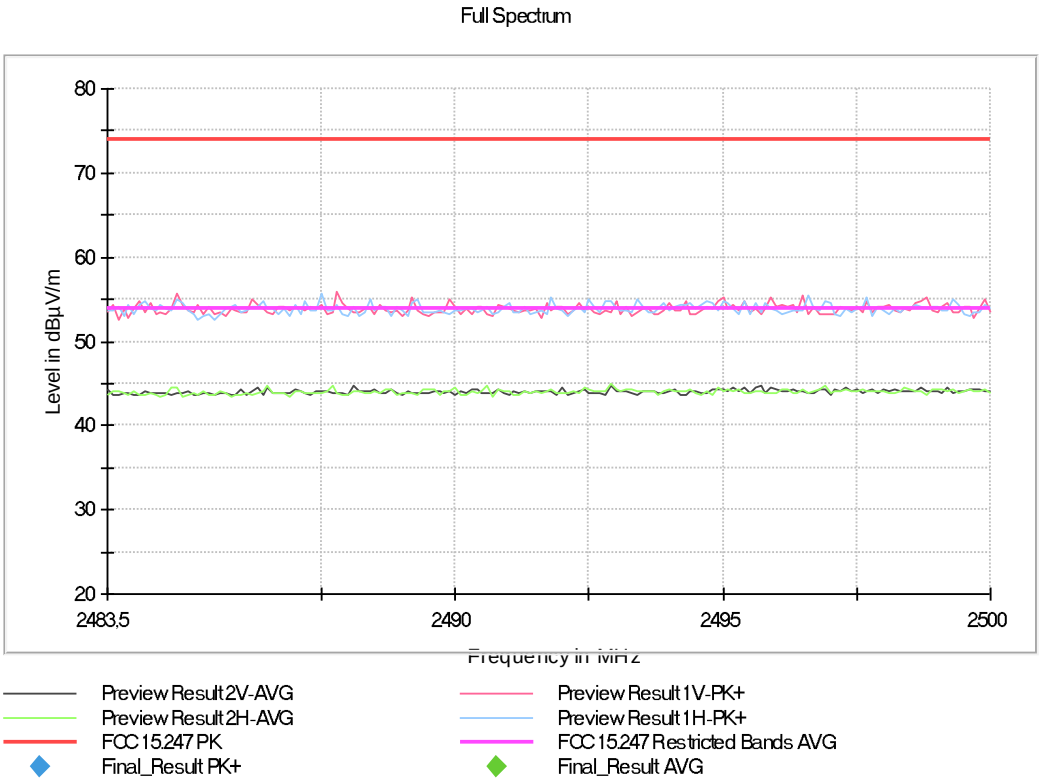
Modulation = BT (8DPSK 3-DH5) Frequency MHz = 2402.00000

MIMO Mode = SISO Active Port = 1

Images:






Full Spectrum
Level in dBµV/m
80
70
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Frequency in MHz
Preview Result 2V-AVG
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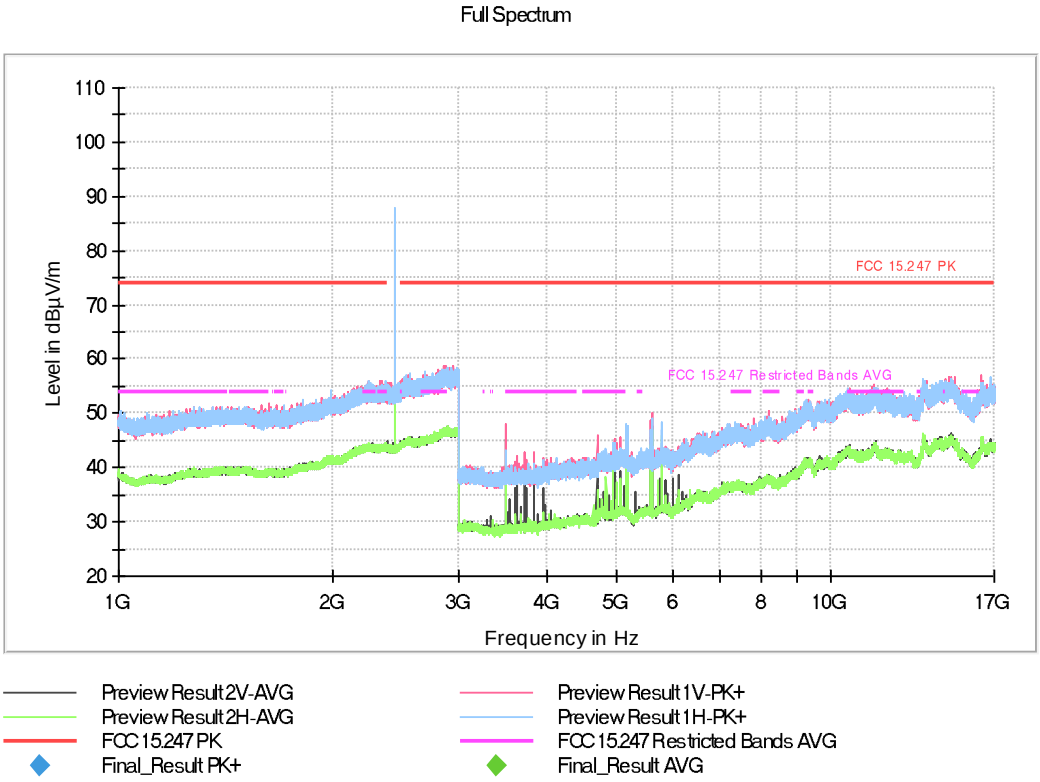
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

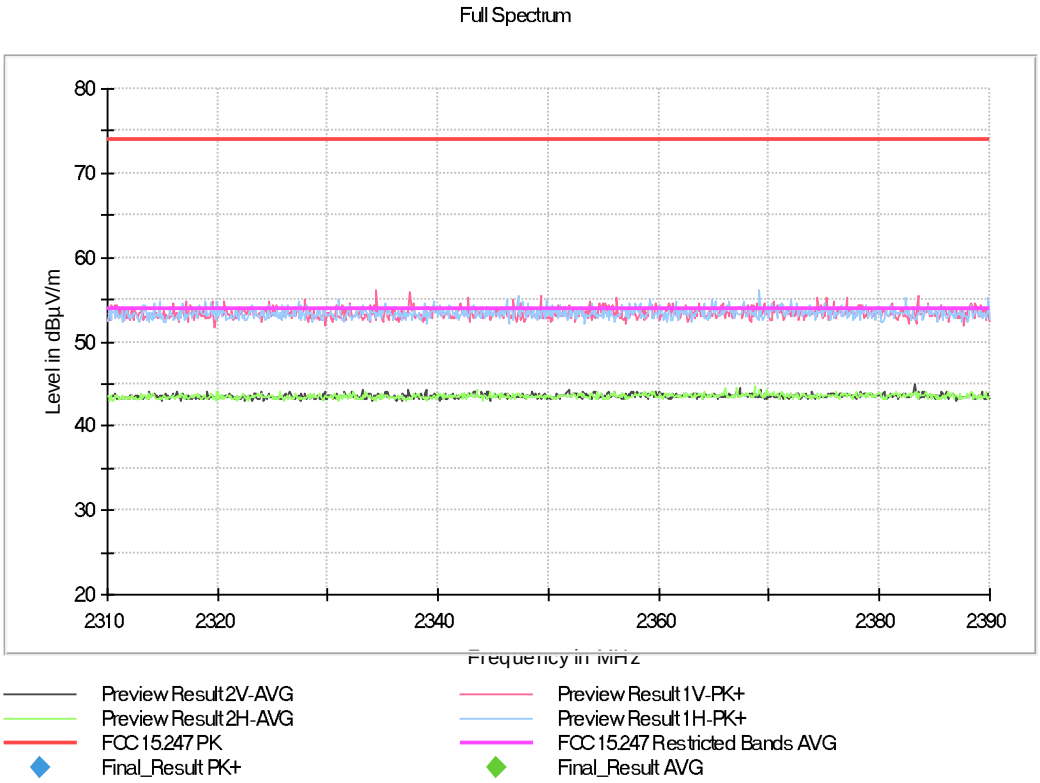
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

Modulation = BT (8DPSK 3-DH5) Frequency MHz = 2441.00000

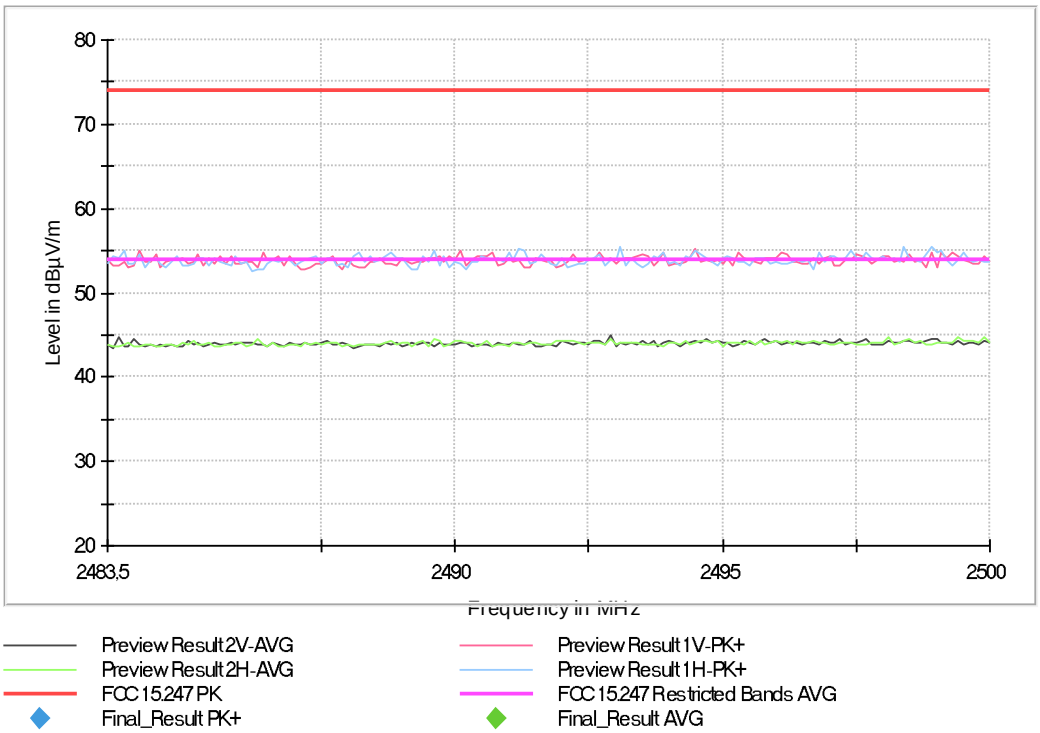
MIMO Mode = SISO Active Port = 1

Images:





Full Spectrum

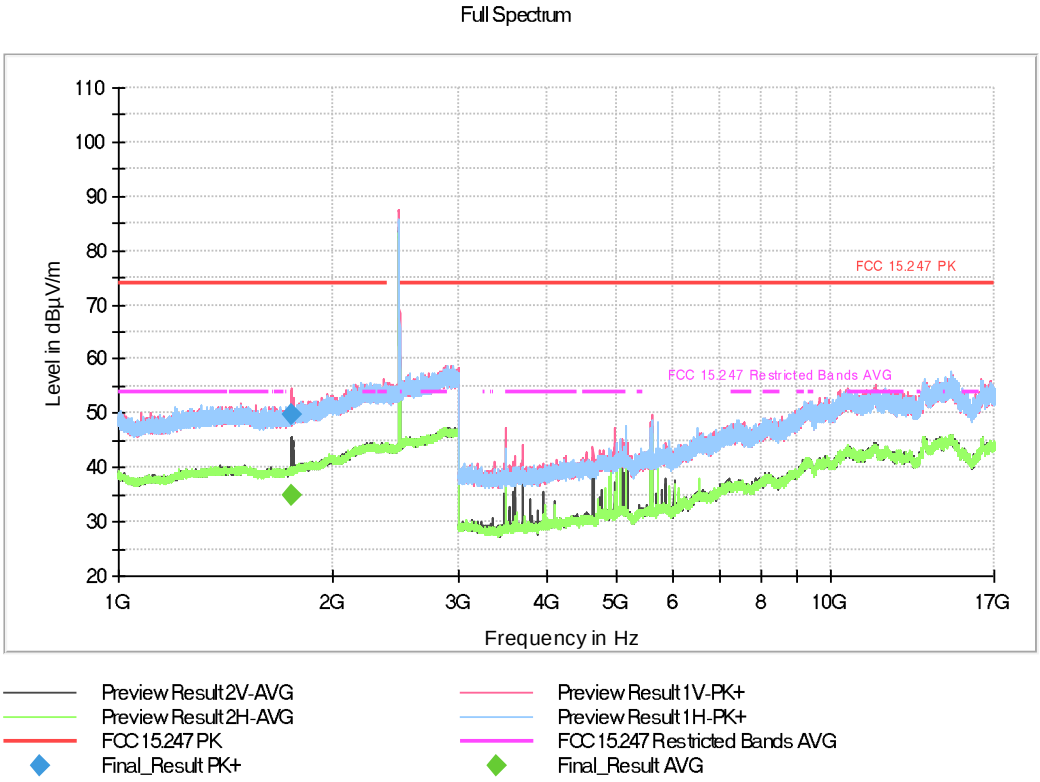


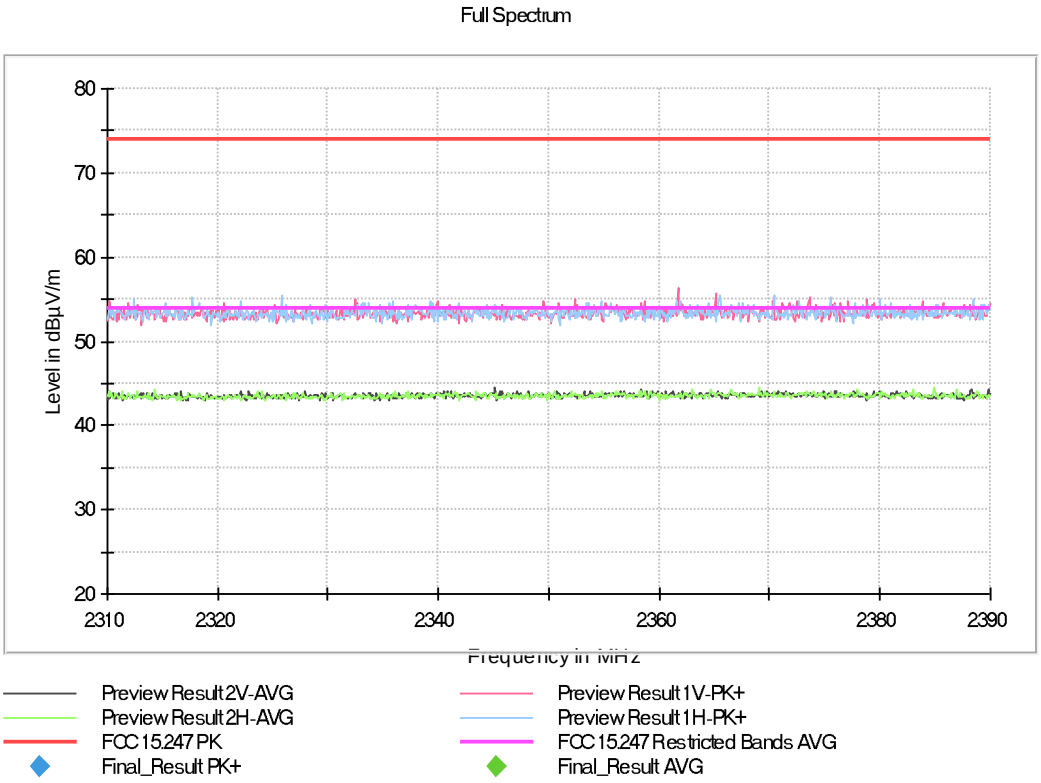
Frequency Range GHz = [1, 17] Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

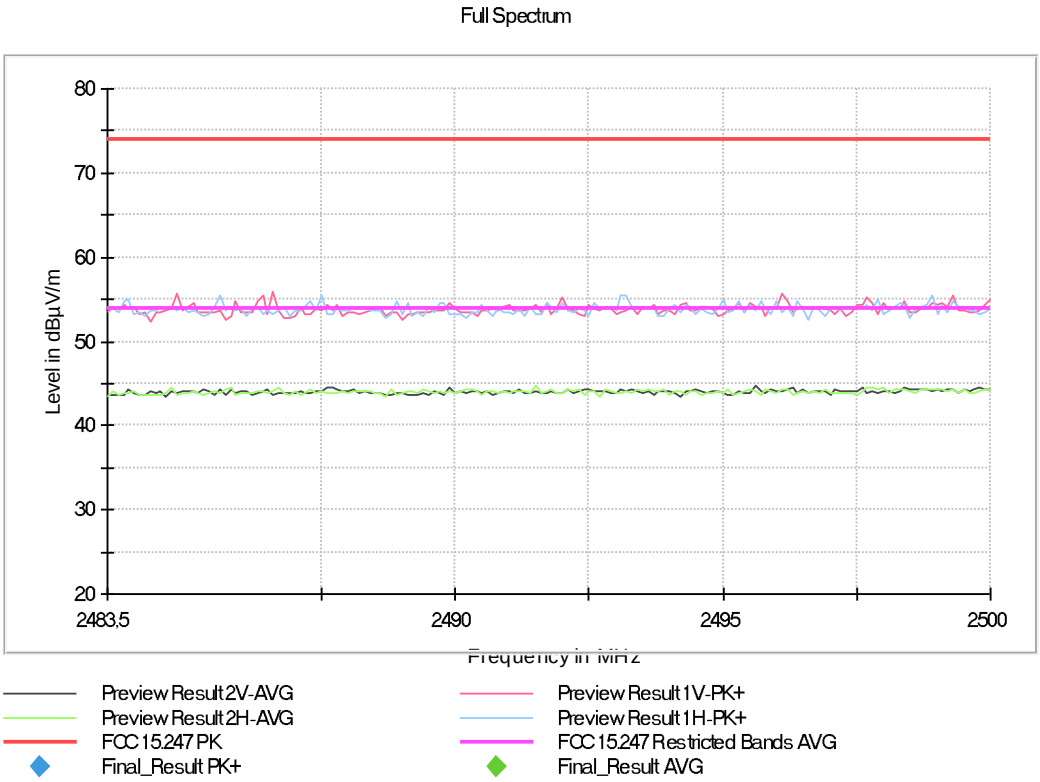
Modulation = BT (8DPSK 3-DH5) Frequency MHz = 2480.00000

MIMO Mode = SISO Active Port = 1

Images:







Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 2,39 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
2,39 GHz - 2,484 GHz	40 kHz	PK+	100 kHz	0,01 s	0 dB
2,484 GHz - 3 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
3 GHz - 17 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Frequency Range GHz = [17, 26]

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS)

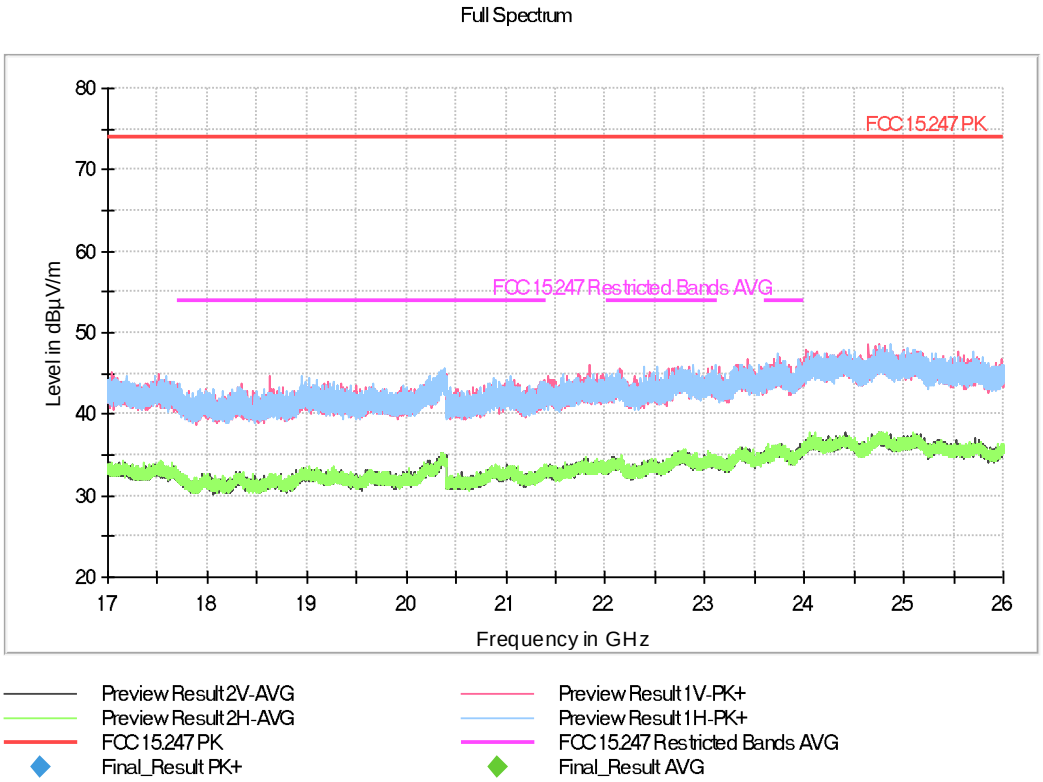
Modulation = The spurious frequencies detected do not depend on the modulation.

Frequency MHz = The spurious frequencies detected do not depend on operating channel.

MIMO Mode = SISO

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
17 GHz - 26 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Appendix C: Test results. 802.11 B/G/N/AX 1x1

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	12 Vdc
Type of Power Supply:	Battery

ANTENNA (*):

Technology	Antenna Gain	Type
WLAN 802.11:	+0.1 dBi	External

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel	Ch 12	Ch 13
802.11b:	1 Mbit/s	2412 MHz	2437 MHz	2462 MHz	2467 MHz	2472 MHz
802.11g:	6 Mbit/s	2412 MHz	2437 MHz	2462 MHz	2467 MHz	2472 MHz
802.11n:	HT20 MCS0 6.5 Mbit/s	2412 MHz	2437 MHz	2462 MHz	2467 MHz	2472 MHz
802.11ax:	HE20 MCS0 SU	2412 MHz	2437 MHz	2462 MHz	2467 MHz	2472 MHz
802.11ax:	HE20 MCS0 RU 26 Worst case according to preliminary PSD testing	2412 MHz	2437 MHz	2462 MHz	2467 MHz	2467 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

POWER ADJUSTMENT (*): 11 dBm

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

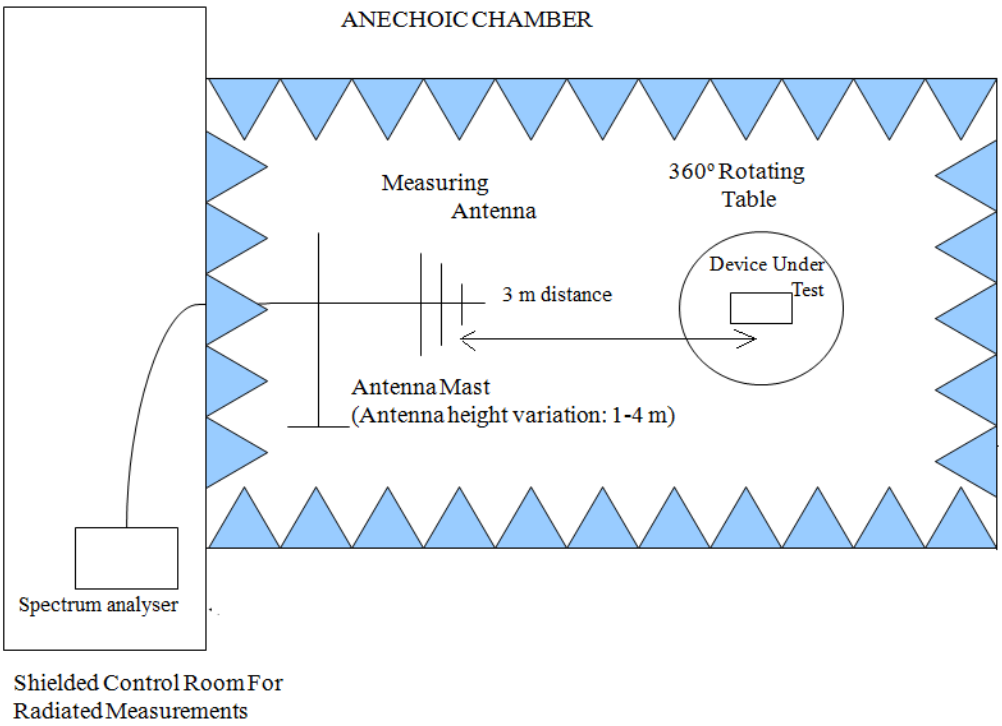
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

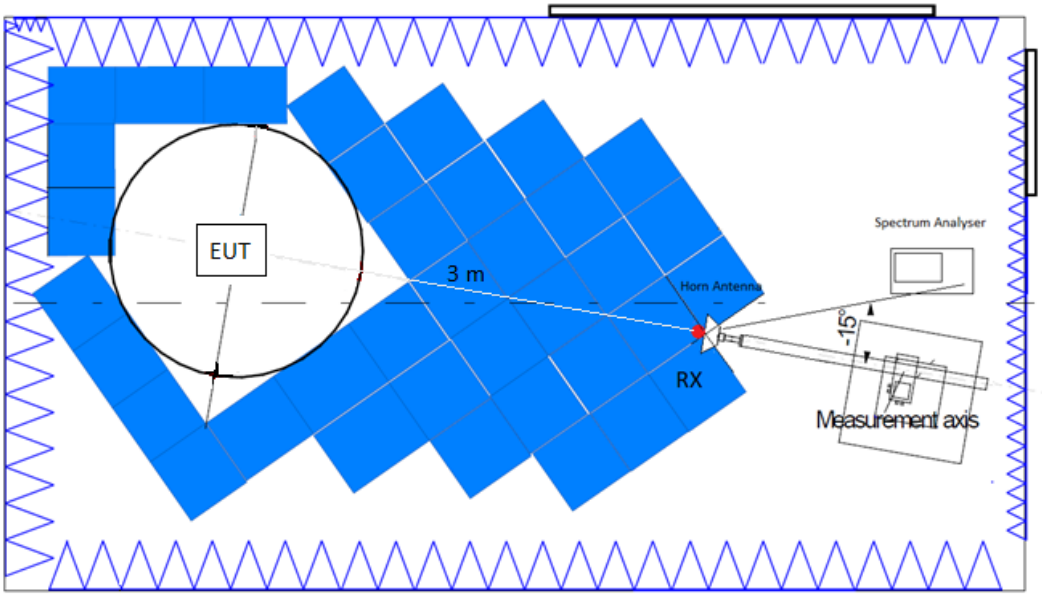
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

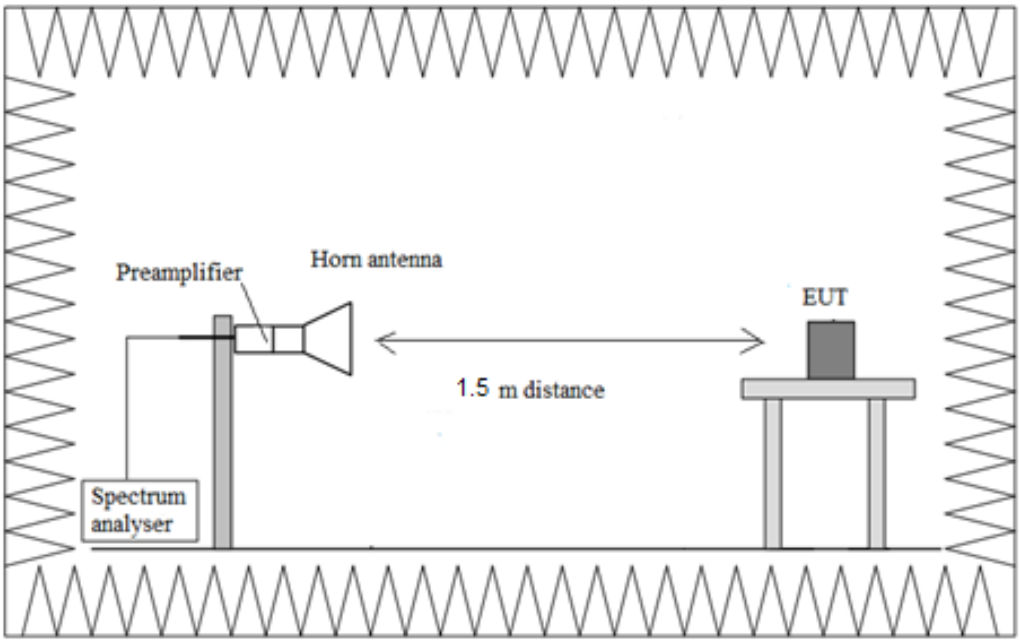
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Average Conducted output Power

Limits

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

The maximum conducted output power level in the fundamental emission was measured using the method according to point 11.9.2.3.2 ”Method AVGPM-G” of ANSI C.63.10-2013.

Results

Worst case channel and modulation only.

Modulation: 802.11b (DSSS 1 Mbit/s)

Freq (MHz)	Peak Power (dBm)	Maximum EIRP Power (dBm)
2412.00000	5.903	6.003

Verdict

Pass

RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)

Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.
Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Results

Modulation: The spurious frequencies detected do not depend on either the modulation or the operating channel.

MIMO Mode: SISO

Freq Rng (GHz)	Equipment	Freq (MHz)	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[0.03, 1]	Digital Transmission System (DTS)	2412.00000	1	77.821	18.89	V	PK
				77.821	14.95	V	QP
				78.403	20.95	V	PK
				78.403	18.40	V	QP
				600.020	31.08	V	PK
				600.020	28.20	V	QP
				893.591	14.74	V	PK
				893.591	19.14	V	QP

Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]

Equipment Type = Digital Transmission System (DTS)

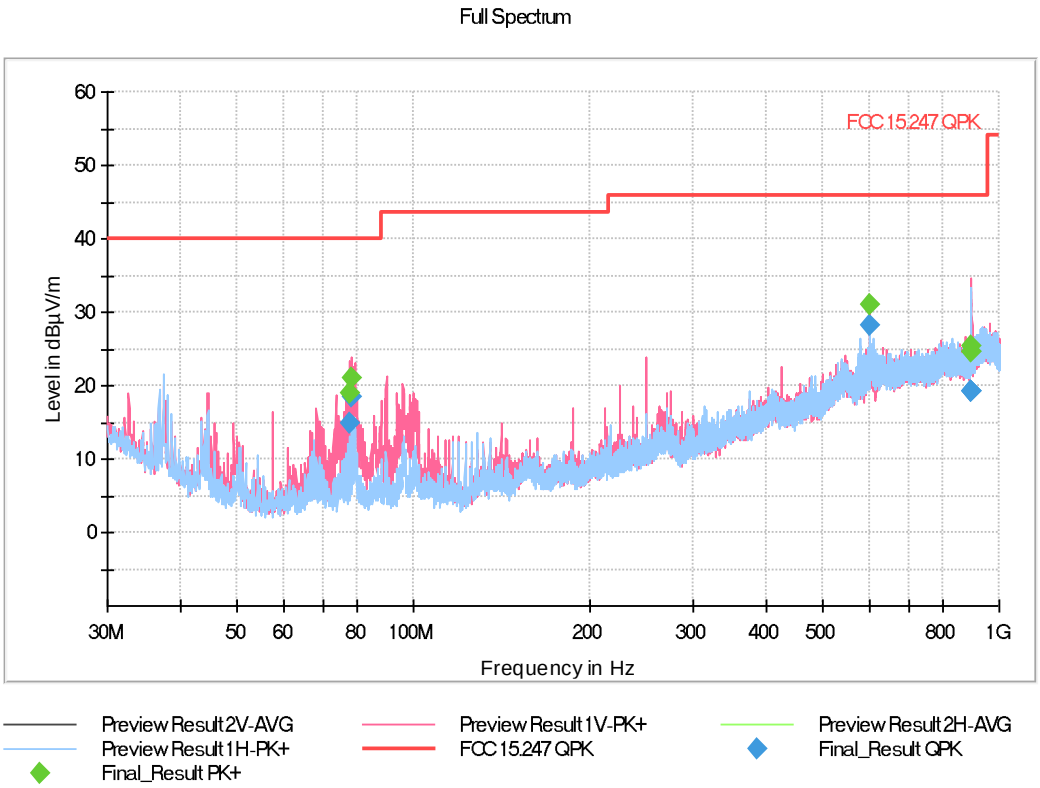
Modulation = The spurious frequencies detected do not depend on the modulation.

Frequency MHz = The spurious frequencies detected do not depend on the operating channel.

MIMO Mode = SISO

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	0 dB

Results

Modulation: 802.11b (DSSS 1 Mbit/s)

MIMO Mode: SISO

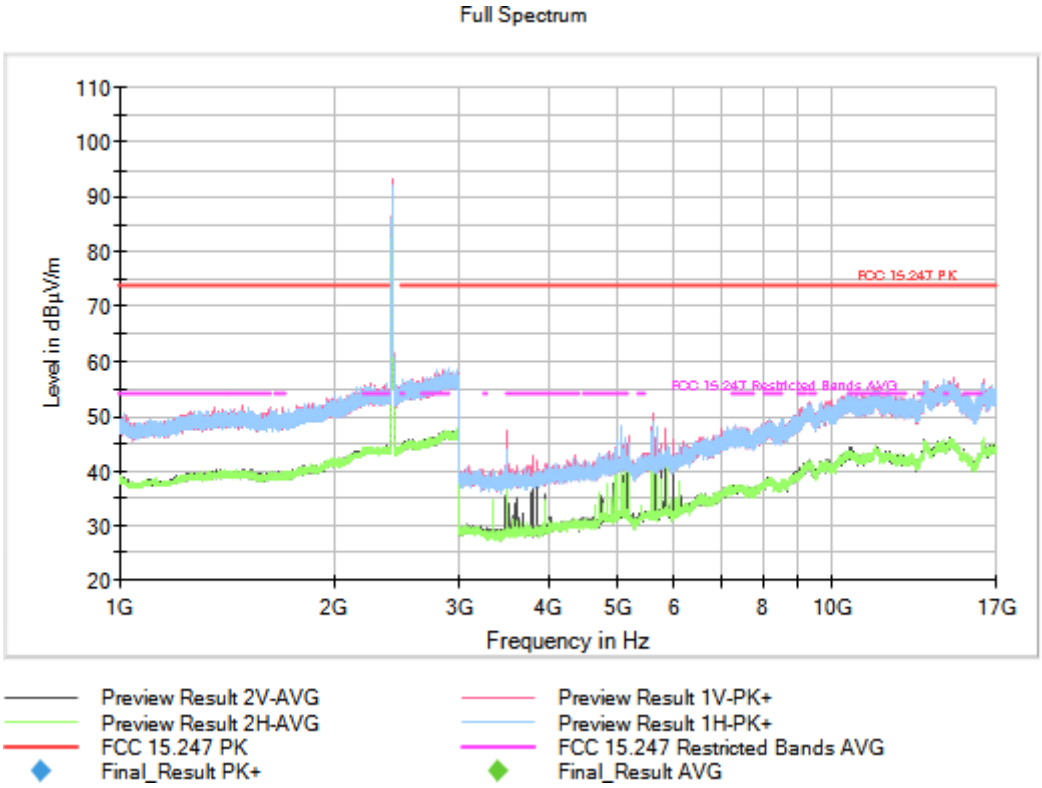
No spurious frequencies detected within 20 dB of the limit.

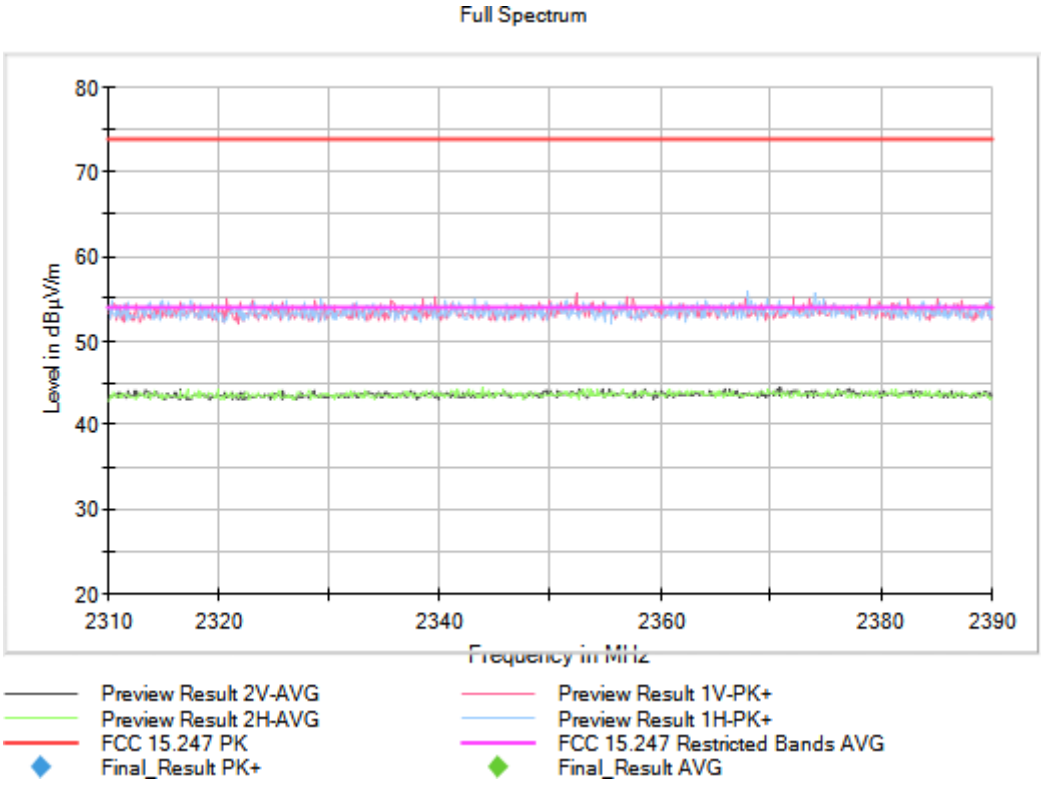
Verdict

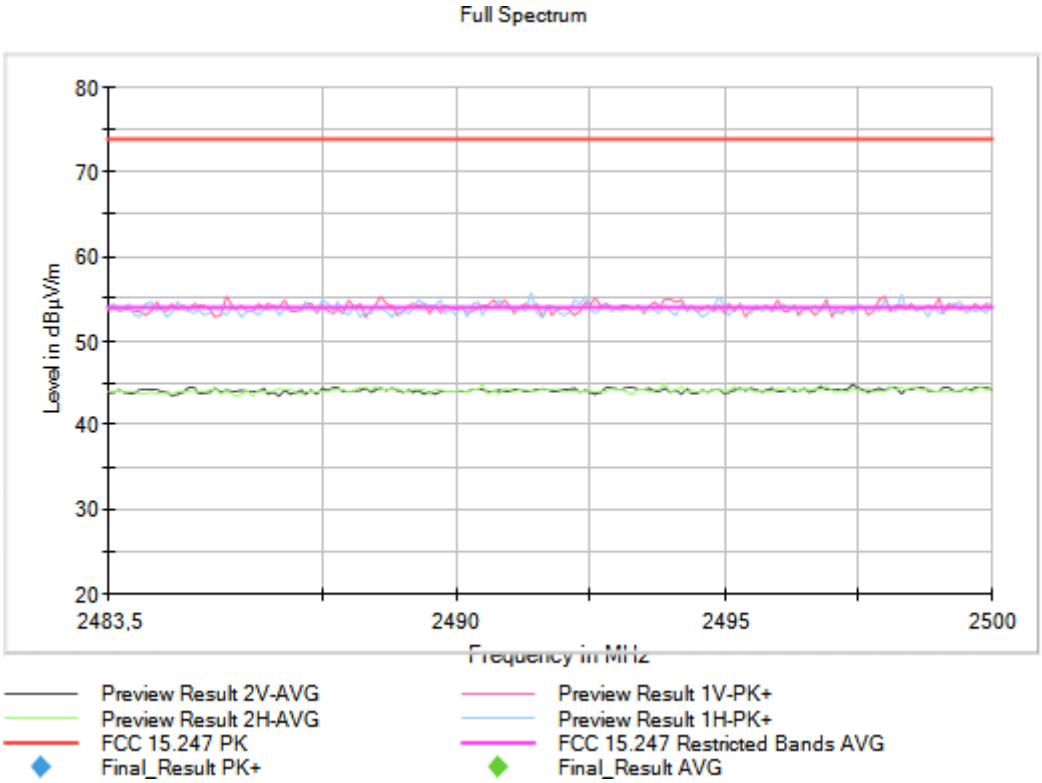
Pass

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11b (DSSS 1 Mbit/s)
Frequency MHz = 2412.00000
MIMO Mode = SISO
Active Port = 1

Images:

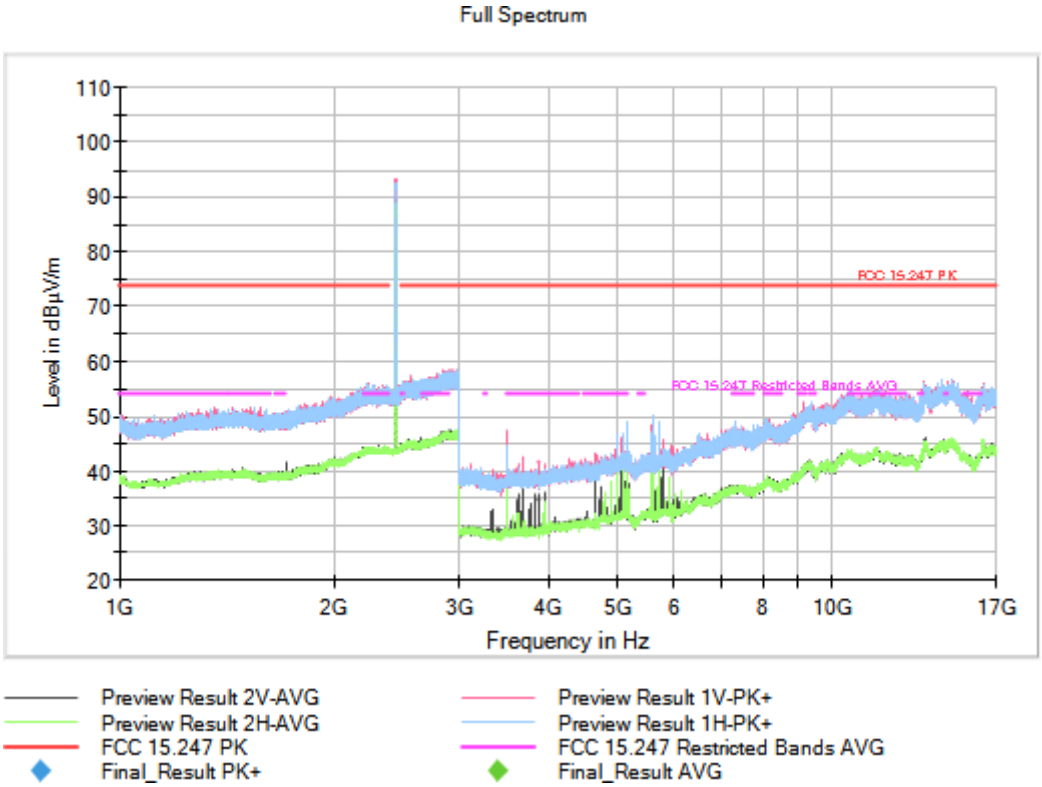


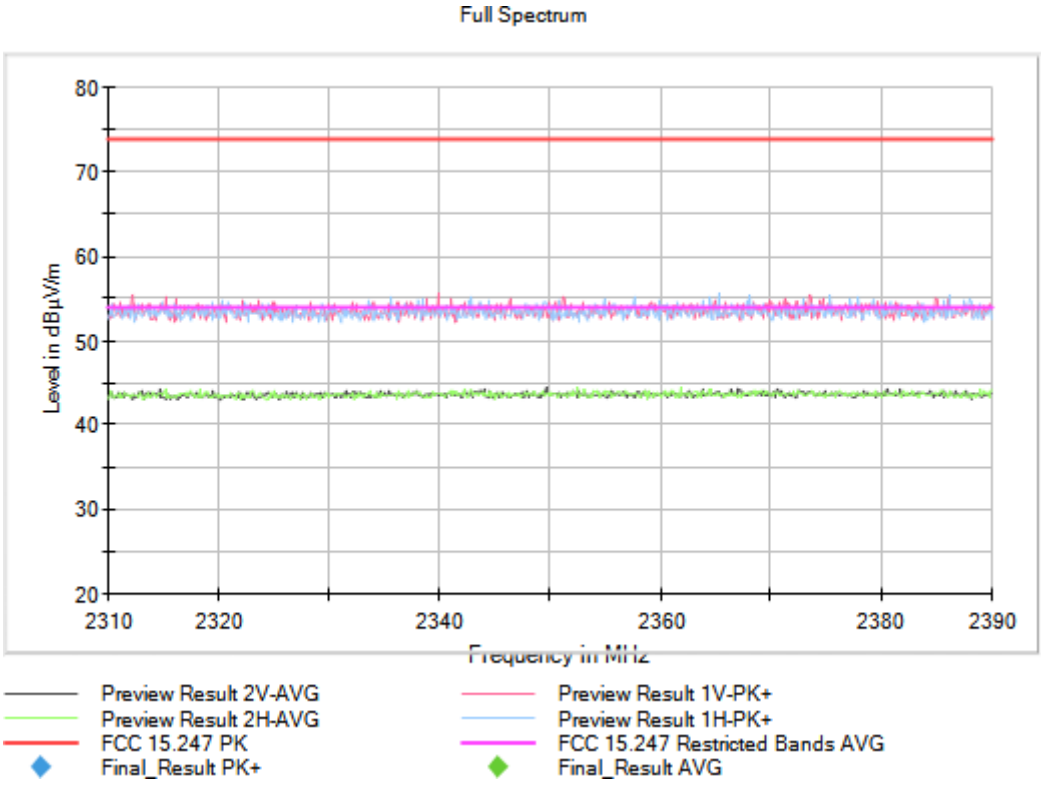


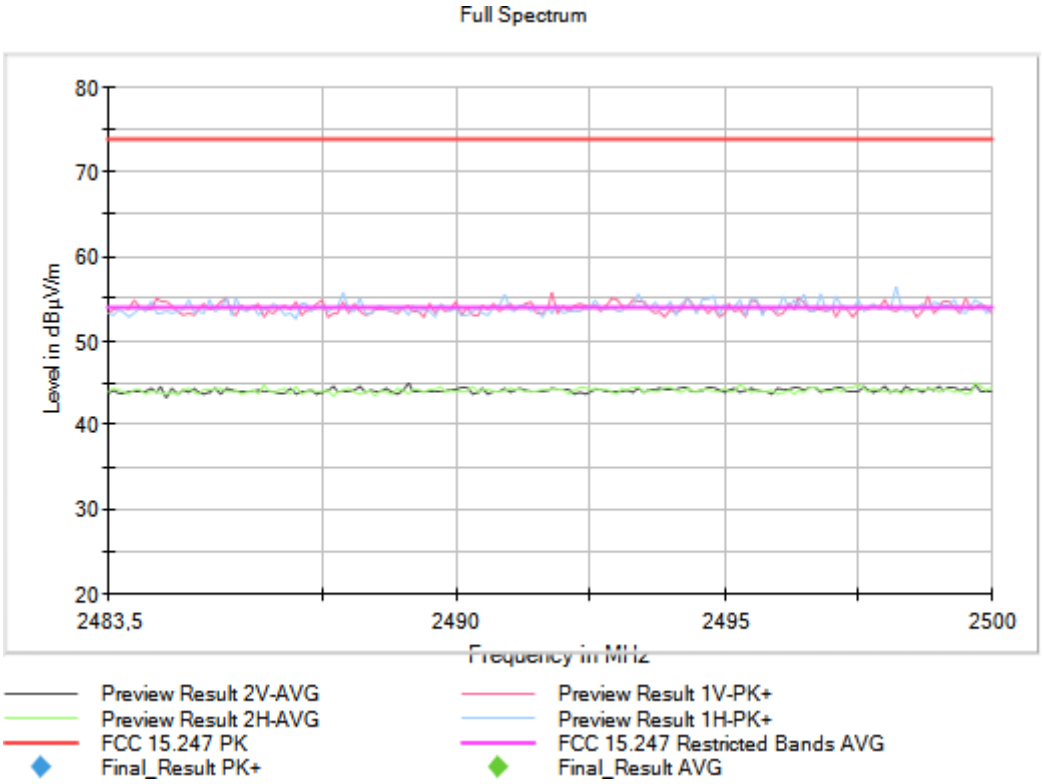

Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11b (DSSS 1 Mbit/s)
Frequency MHz = 2437.00000
MIMO Mode = SISO
Active Port = 1

Images:

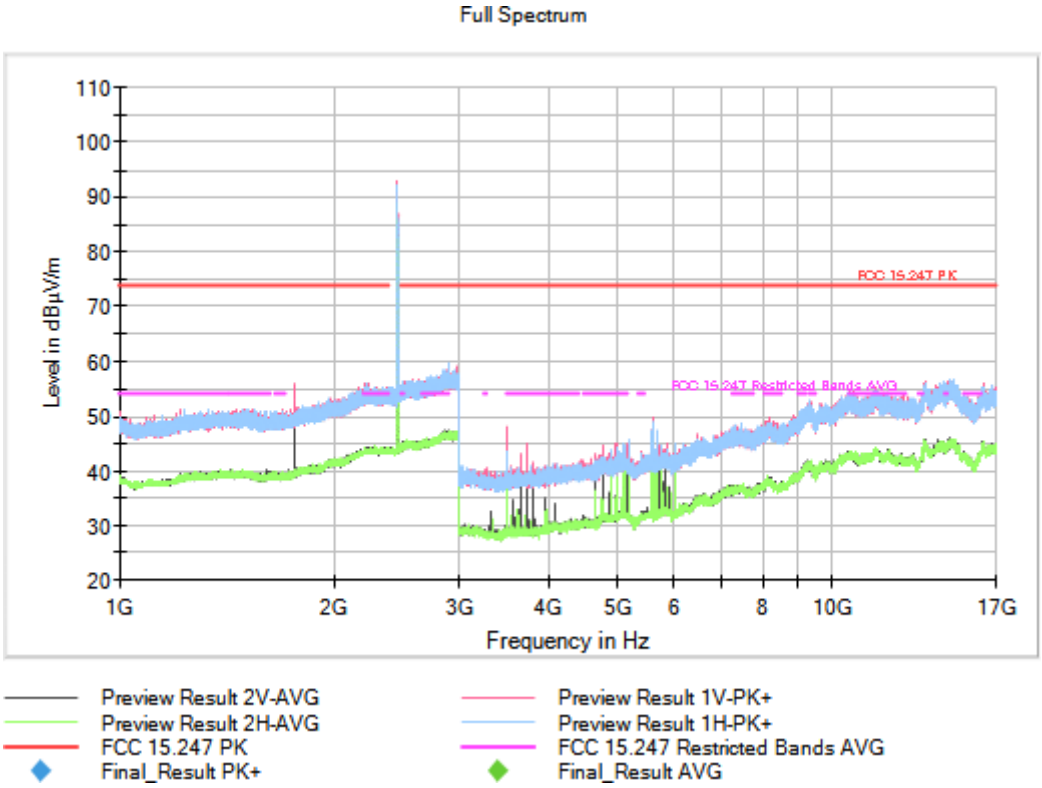


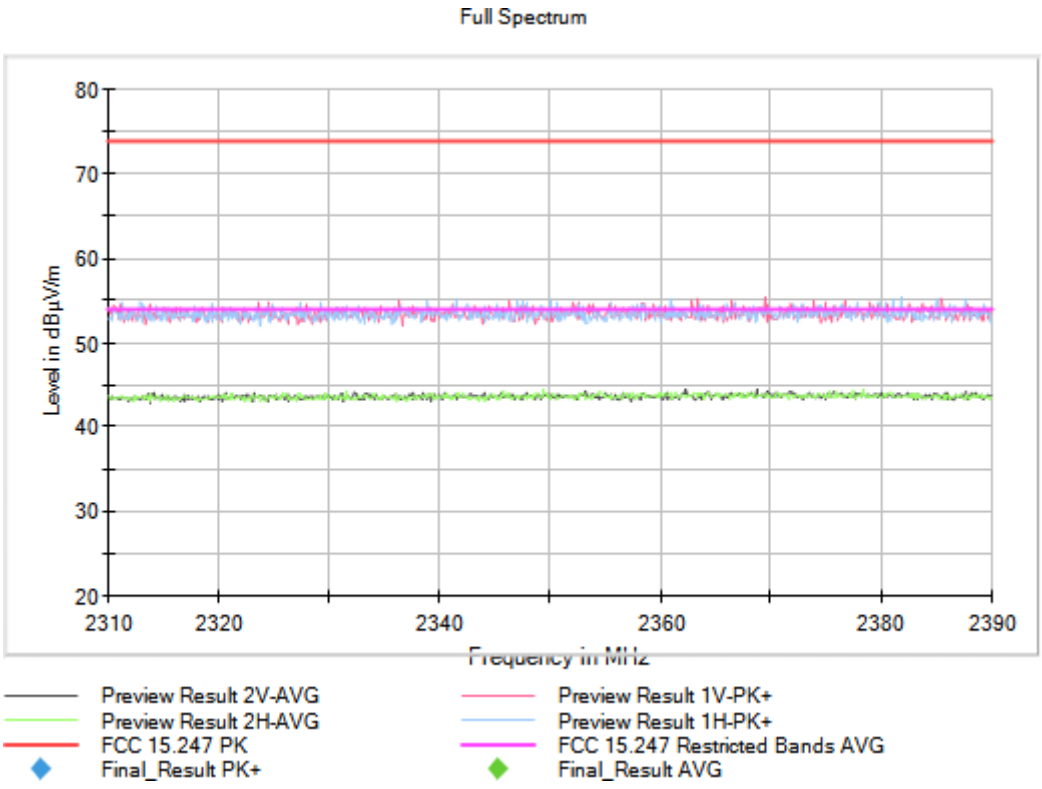


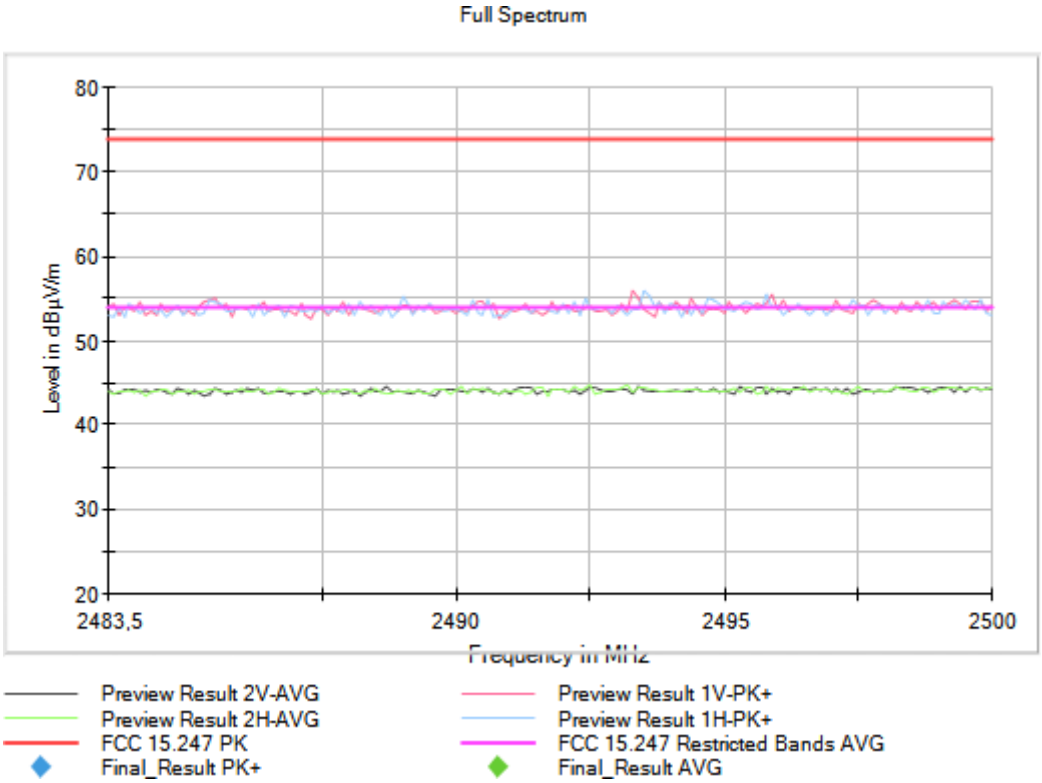

Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11b (DSSS 1 Mbit/s)
Frequency MHz = 2462.00000
MIMO Mode = SISO
Active Port = 1

Images:

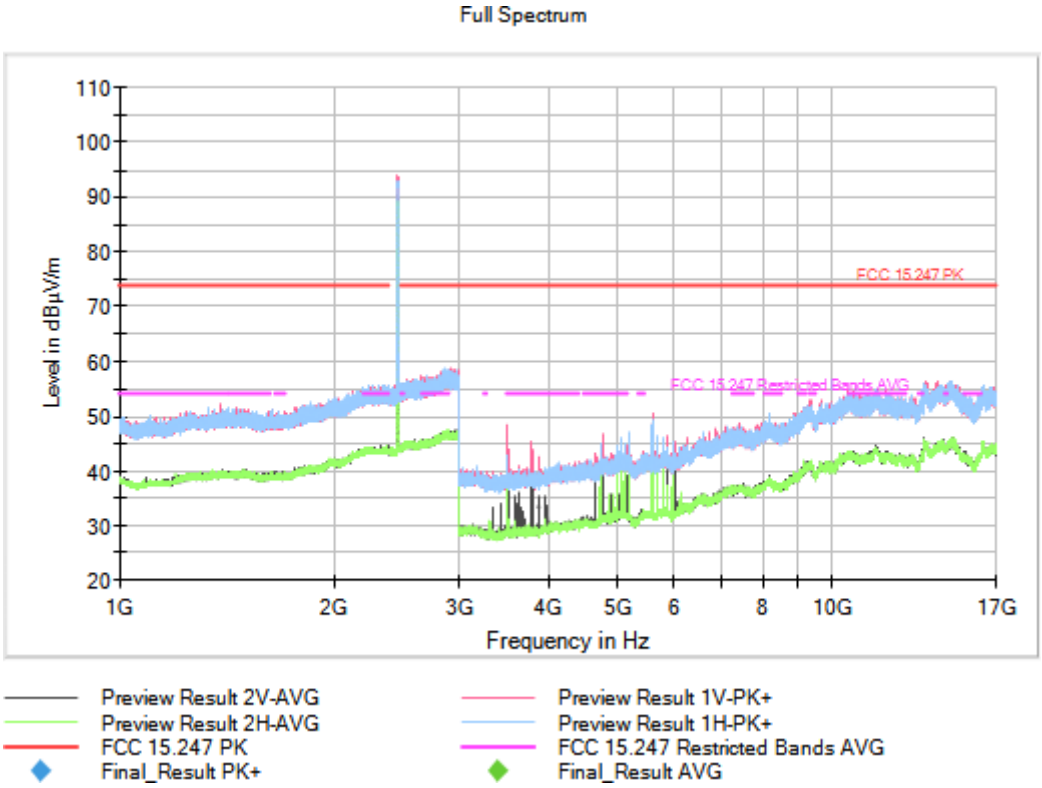


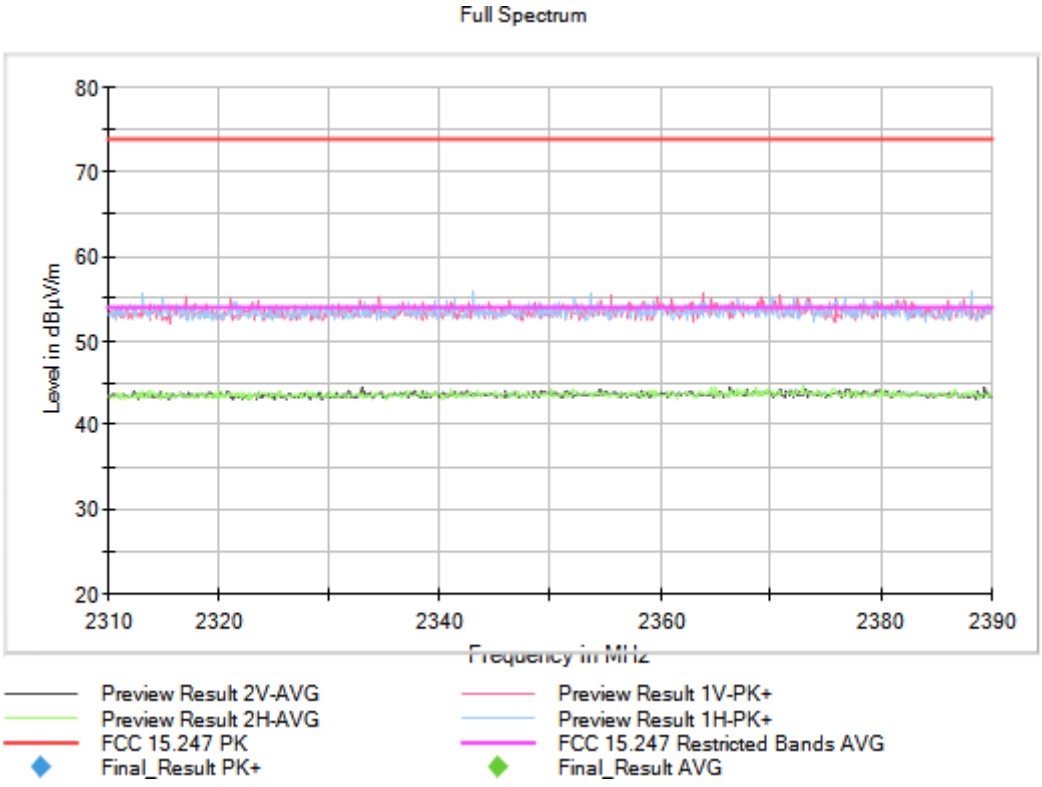


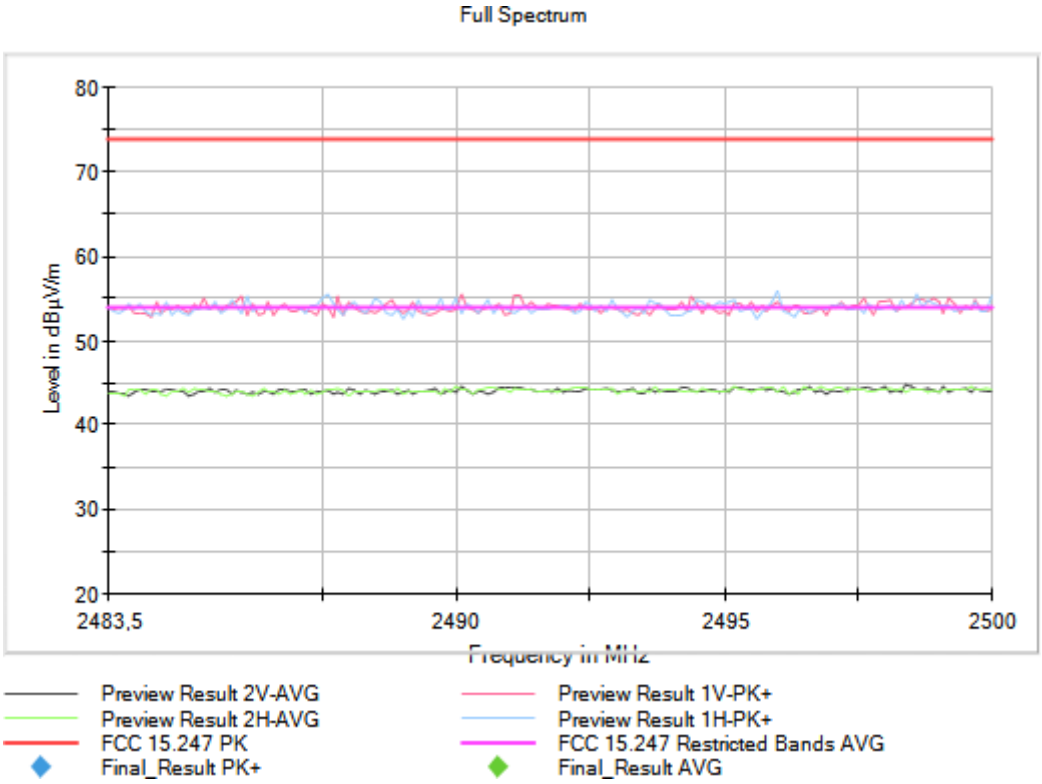

Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11b (DSSS 1 Mbit/s)
Frequency MHz = 2467.00000
MIMO Mode = SISO
Active Port = 1

Images:

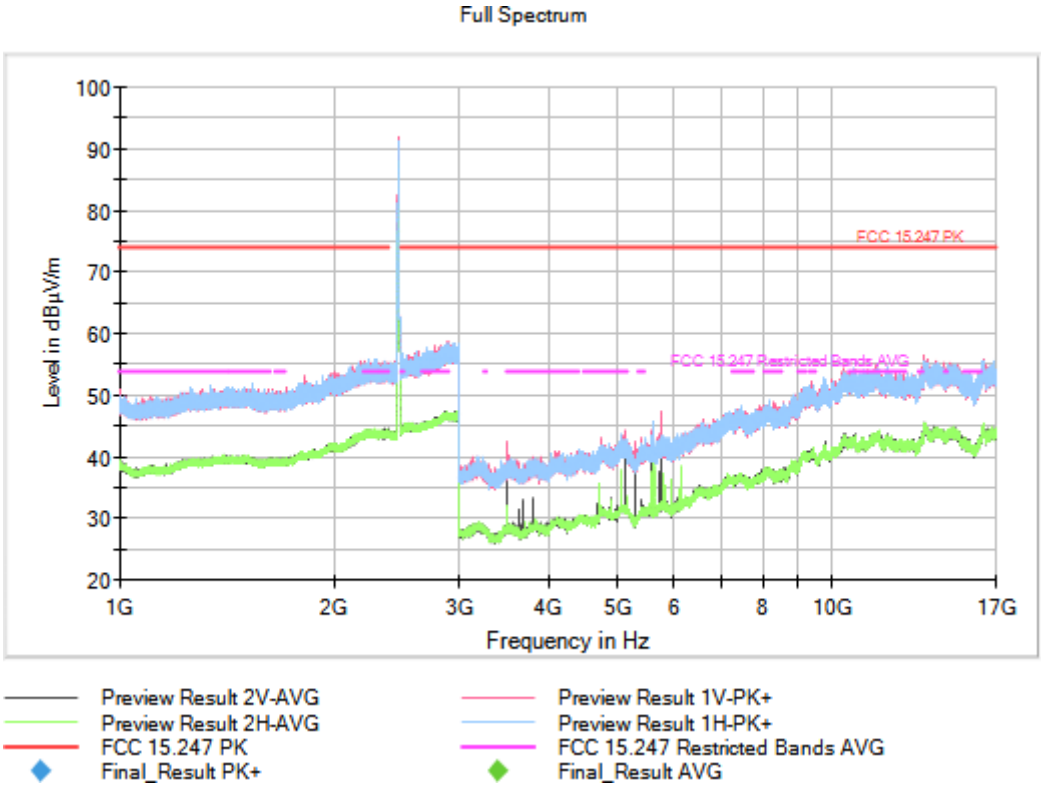


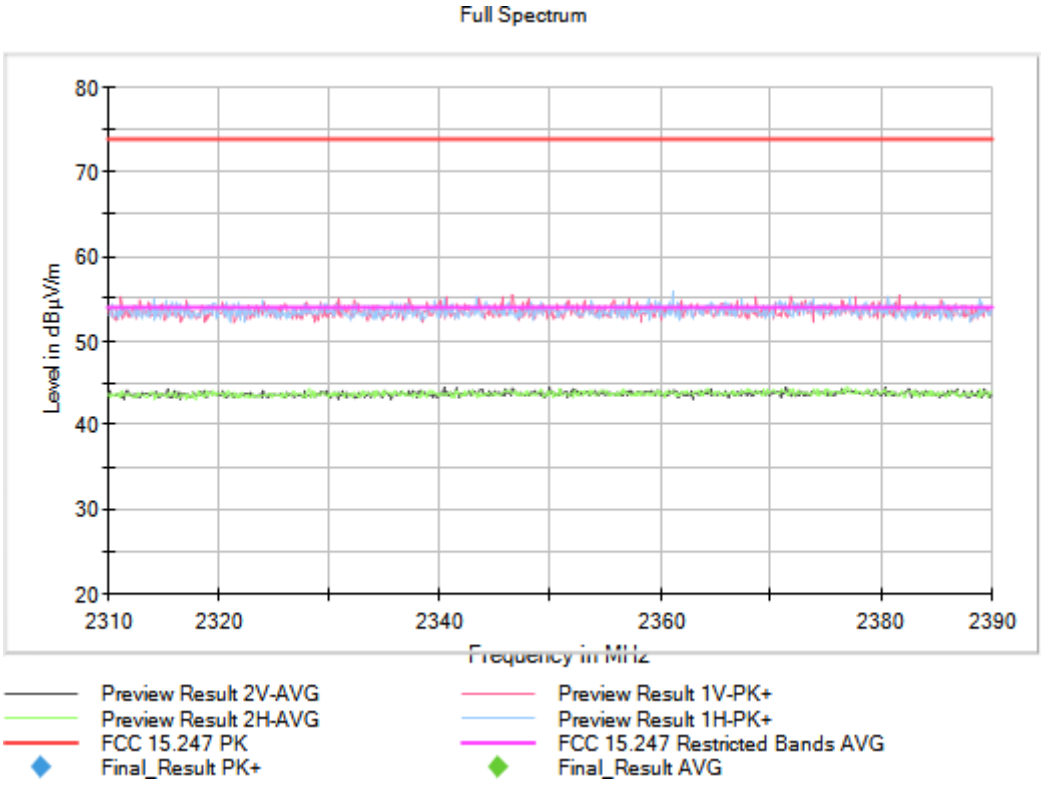


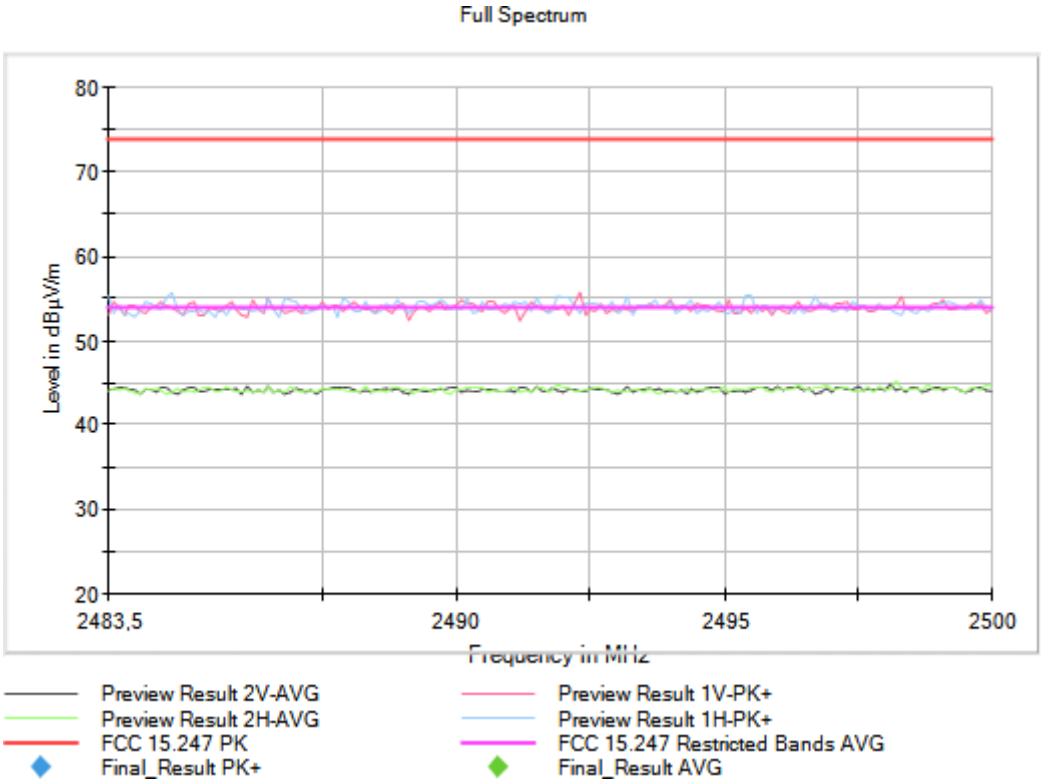

Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11b (DSSS 1 Mbit/s)
Frequency MHz = 2472.00000
MIMO Mode = SISO
Active Port = 1

Images:






Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Results

Modulation: 802.11g (OFDM 6 Mbit/s)

MIMO Mode: SISO

Freq Rng (GHz)	Equipment	Freq (MHz)	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
[1, 17]	Digital Transmission System (DTS)	2472.00000	1	2483.500	46.27	V	AVG
				2483.500	63.00	V	PK

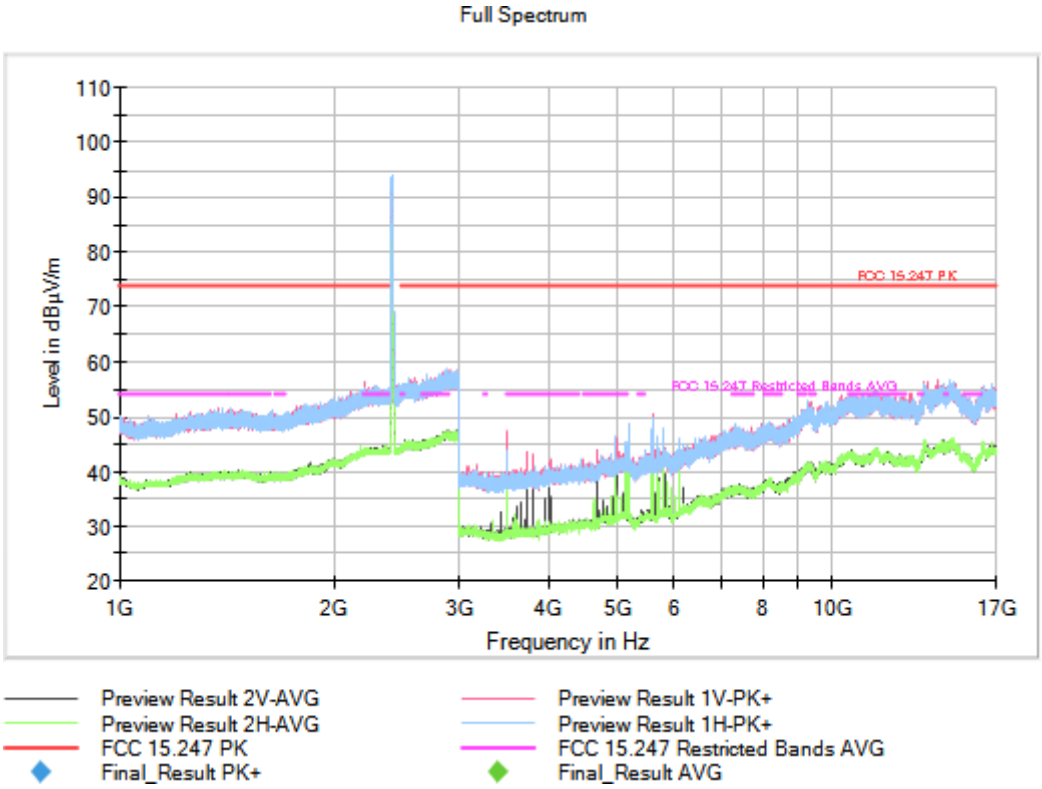
Verdict

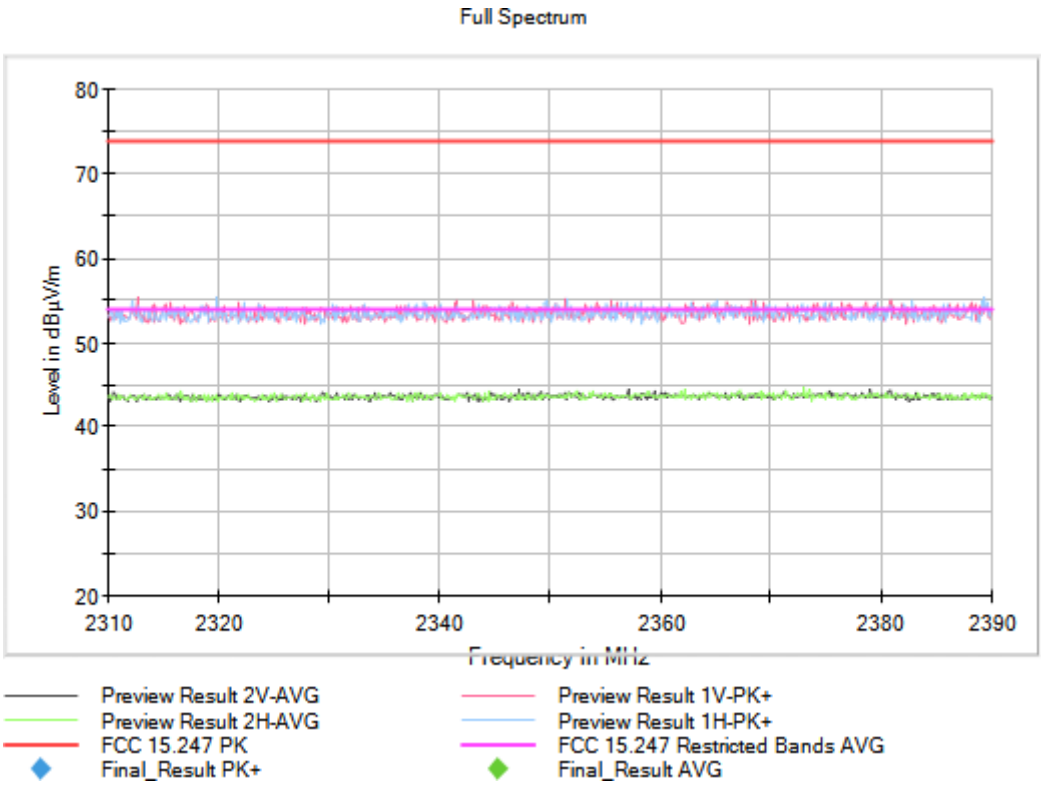
Pass

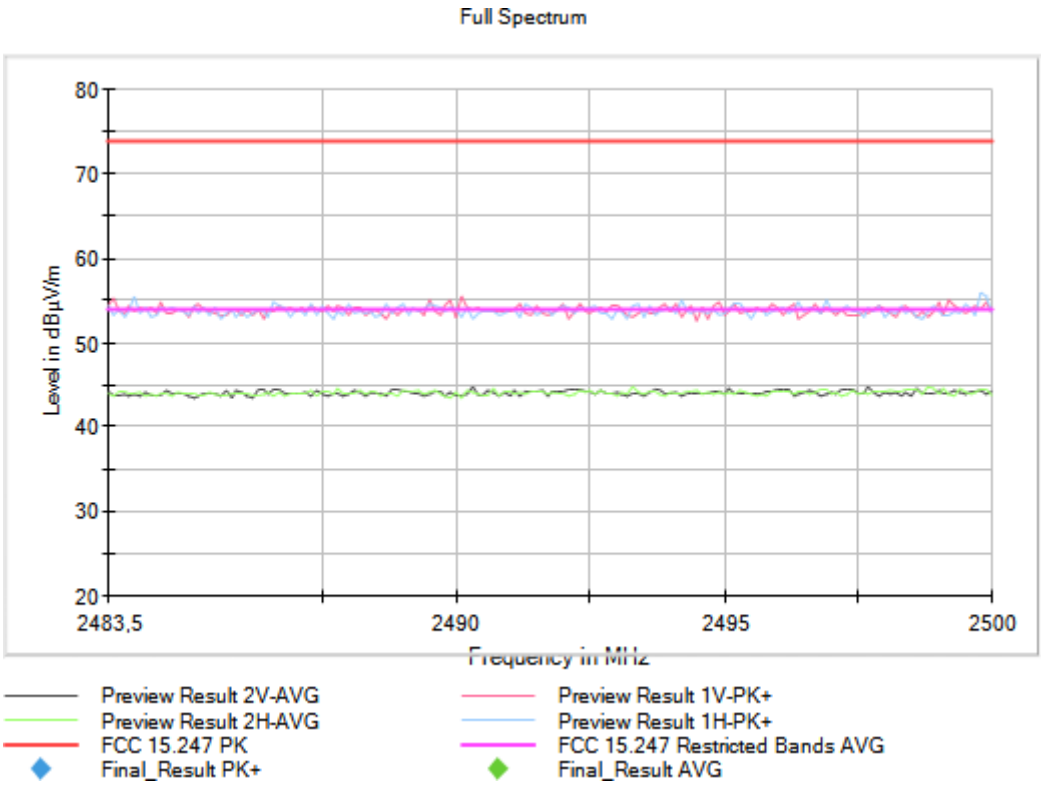
Attachments

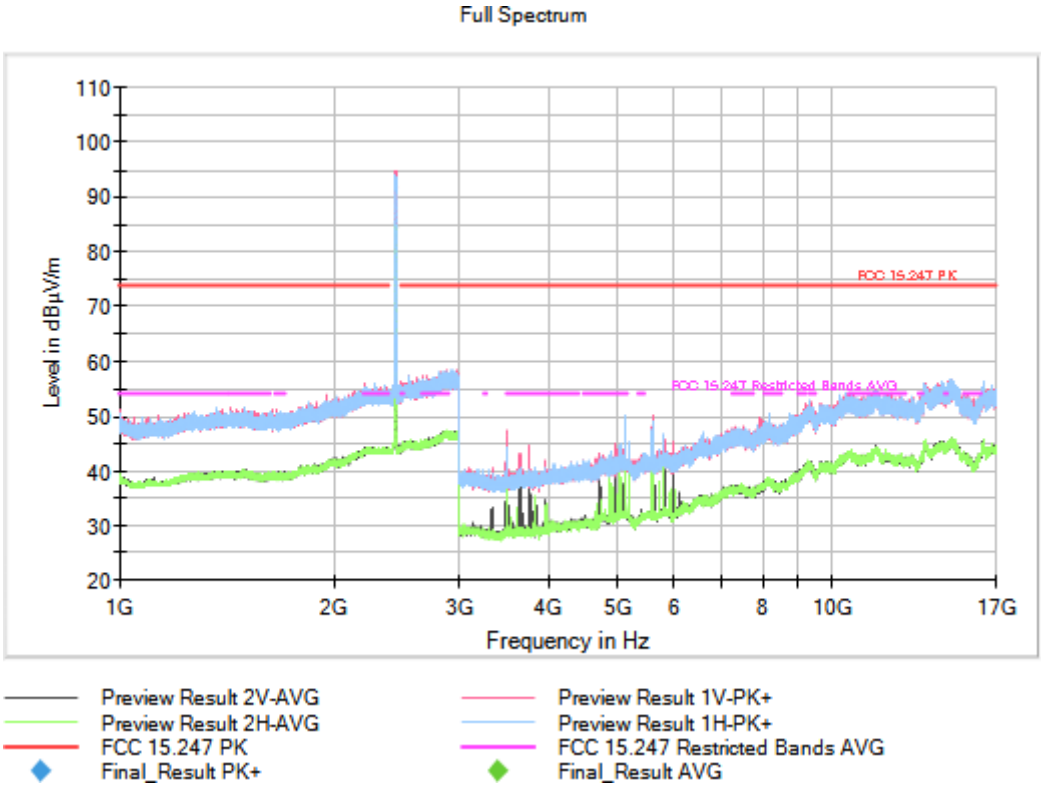
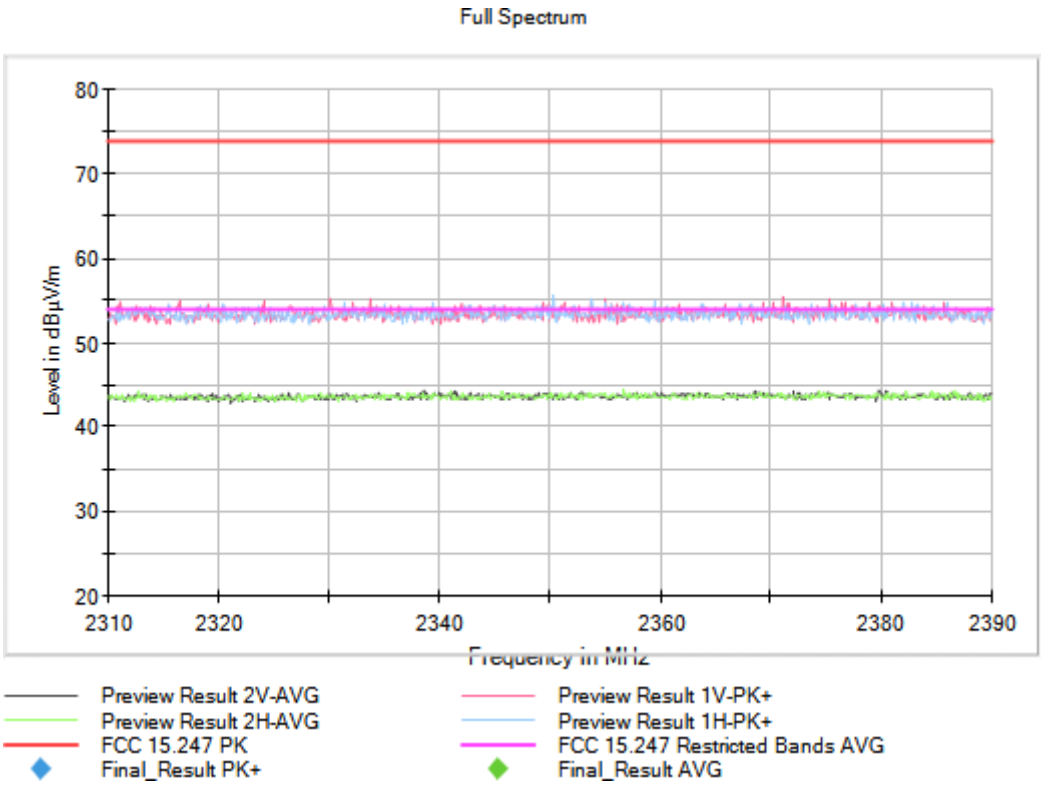
Frequency Range GHz = [1, 17]	Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11g (OFDM 6 Mbit/s)	Frequency MHz = 2412.00000
MIMO Mode = SISO	Active Port = 1

Images:






Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [1, 17]
Equipment Type = Digital Transmission System (DTS)
Modulation = 802.11g (OFDM 6 Mbit/s)
Frequency MHz = 2437.00000
MIMO Mode = SISO
Active Port = 1

Images: